AD-A103 762 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CLOVE LAKE DAM (NJ 00259) DELAWARE--ETC(U)
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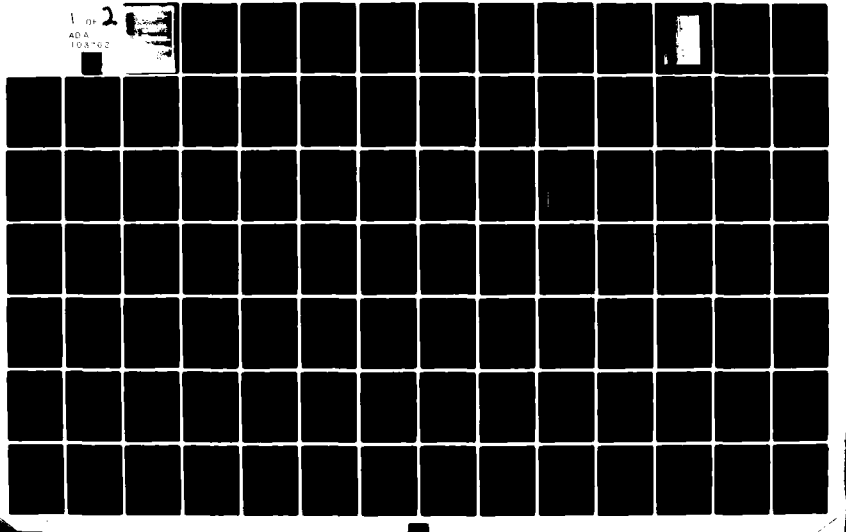

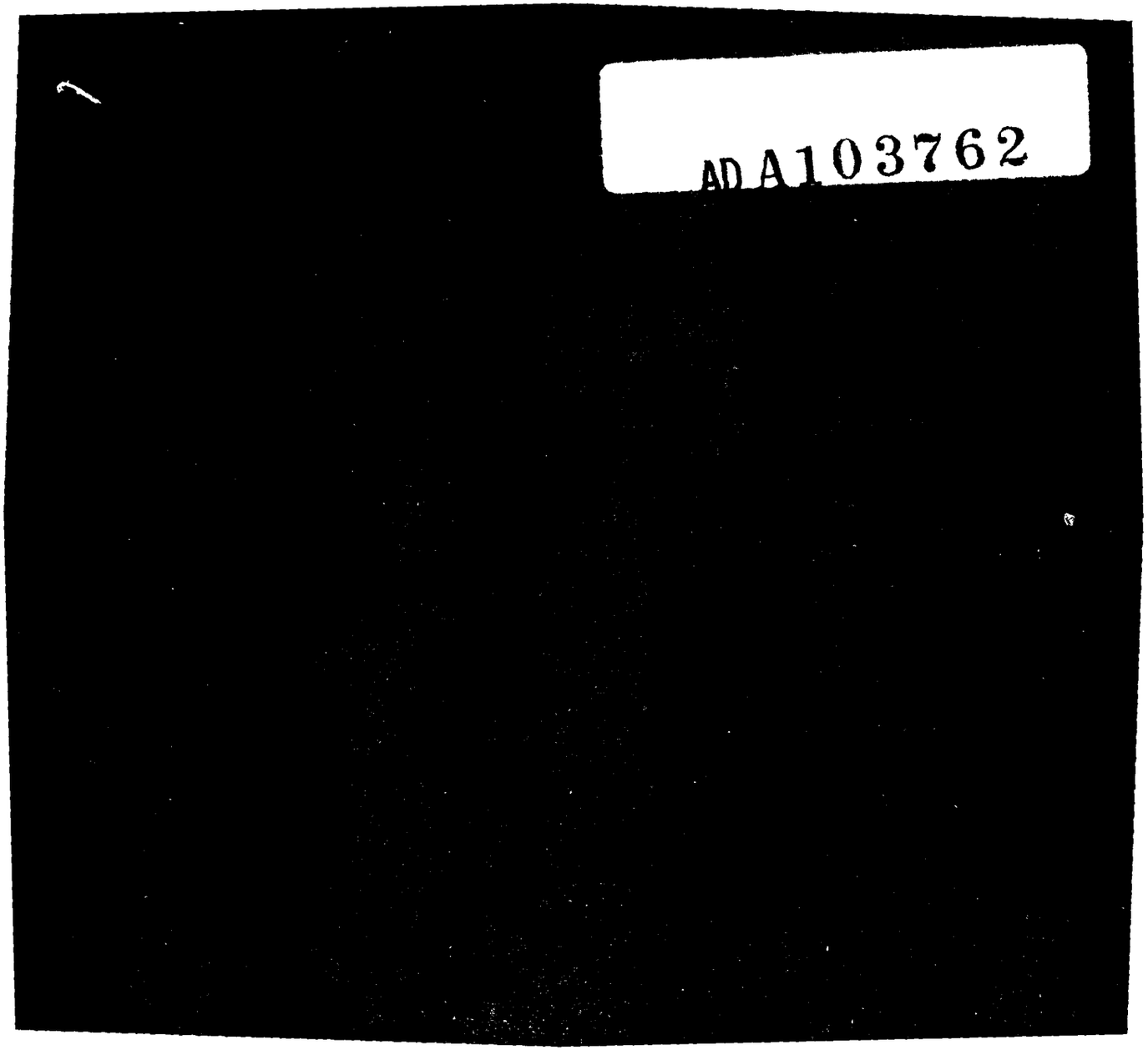
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18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program
Embankments	Clove Lake Dam, N.J.
Visual Inspection	Erosion
Structural Analysis	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-N

31 AUG 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Clove Lake Dam in Sussex County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Clove Lake Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reasons no further studies are recommended. However, to assure the continued functioning of the dam and its impoundment, the following remedial actions could be undertaken by the owner:

a. Repair the erosion of the upstream slope of the dam and provide erosion protection.

b. Remove trees and brush from the downstream slope and at the downstream toe of the dam.

c. Provide a satisfactory outlet for the 8-inch diameter AC siphon pipe, if its continued use is required.

d. Repair the eroded areas on the downstream slope of the dam.

e. If required, implement remedial measures for the wet and soft areas at the toe of the dam.

f. Repair the concrete spillway and fish ladder, and the stoplog facilities.

g. Relocate the gate valve box for the twin 18-inch draw-down pipes to place the valves on the upstream side of the dam.

h. Start a program of periodically checking the condition of the dam and monitoring the wet area along the toe.

i. Control trespassing on the slopes of the dam.

j. Provide a drain or other means for removing water collecting in the low-level outlet chamber.

k. Reestablish and maintain grass and vegetation on the dam after repairs are made to the eroded areas on the downstream slopes.

l. Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

m. Regularly monitor the condition of the wood decking and steel supports of the service bridge over the spillway and repair as required.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-N
Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

CLOVE LAKE DAM (NJ00259)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 22 April 1981 by Anderson-Nichols and Co. Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Clove Lake Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reasons no further studies are recommended. However, to assure the continued functioning of the dam and its impoundment, the following remedial actions could be undertaken by the owner:

a. Repair the erosion of the upstream slope of the dam and provide erosion protection.

b. Remove trees and brush from the downstream slope and at the downstream toe of the dam.

c. Provide a satisfactory outlet for the 6-inch diameter AC siphon pipe, if its continued use is required.

d. Repair the eroded areas on the downstream slope of the dam.

e. If required, implement remedial measures for the wet and soft areas at the toe of the dam.

f. Repair the concrete spillway and fish ladder, and the stoplog facilities.

g. Relocate the gate valve box for the twin 18-inch draw-down pipes to place the valves on the upstream side of the dam.

h. Start a program of periodically checking the condition of the dam and monitoring the wet area along the toe.

i. Control trespassing on the slopes of the dam.

j. Provide a drain or other means for removing water collecting in the low-level outlet chamber.

k. Reestablish and maintain grass and vegetation on the dam after repairs are made to the eroded areas on the downstream slopes.

l. Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

m. Regularly monitor the condition of the wood decking and steel supports of the service bridge over the spillway and repair as required.

APPROVED: Roger Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 31 Aug 81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Clove Lake
Identification No.:	Fed ID No. NJ00259
State Located:	New Jersey
County Located:	Sussex
Stream:	Shimers Brook
River Basin:	Delaware
Date of Inspection:	April 22, 1981

ASSESSMENT OF GENERAL CONDITIONS

Clove Lake Dam is 17 years old and in fair condition. The dam is 400 feet long with earth embankment over clay and concrete cores. Included in its length is a 120-foot concrete ogee spillway, 3 stoplog sections, and a box-type fish ladder. Two 18-inch C.I. lines, valved on the downstream slope, and an 8-inch AC pipe siphon allow the reservoir to be drained in an emergency. A 24-foot wide asphaltic topped road runs along the axis of the embankments and the spillway is crossed by a wood-decked, steel-framed bridge. Considerable erosion has occurred at and above the waterline on the upstream slope. Also, a few trees and some brush are growing on the upstream slope. Heavier growth of trees, brush, and debris were found on the downstream slope. Considerable erosion, primarily caused by trespassing, has occurred on the embankments downstream, especially along the spillway training walls. Some erosion gullies on the downstream slope extend from toe to crest. The concrete in the fish ladder is severely deteriorated exposing reinforcing steel. The spillway crest shows some spalling and the service bridge shows corrosion of the steel posts at the waterline. The area of the downstream toe is generally wet and soft and contains an extensive growth of wetlands type vegetation. Ponded water was observed along the downstream toe but no flowing water was observed. The spillway can pass the 100-year spillway design flood and is considered to have adequate capacity.

Clove Lake Dam does not pose a potential hazard to loss of life and only minimal property damage could occur if it should be breached. However, should the owner wish to maintain the integrity of the embankment, he should retain the services of a professional engineer, qualified in the design and construction of dams to accomplish the following in the time periods specified: Starting soon: conduct a stability analysis of the spillway including consideration of loading from ice and vacuum; design or specify repairs for the erosion of the upstream slope of the dam and design or specify erosion protection for the upstream slope of the dam; design and oversee procedures for the removal of trees and brush from the downstream slope and at the downstream toe of the dam; investigate the need for leaving the 8-inch diameter AC pipe siphon in place and design

a satisfactory outlet for the pipe, if it is required; design and oversee repairs for the eroded areas on the downstream slope of the dam; investigate the cause of the wet and soft areas at the toe of the dam and design remedial measures, if required. In the near future: design and oversee procedures to repair the concrete spillway and fish ladder, and the stoplog facilities; relocate the gate valve box for the twin 18-inch draw-down pipes to place the valves on the upstream side of the dam.

It is further recommended that the owner accomplish the following tasks as part of operational and maintenance procedures. Beginning soon: Start a program of periodically checking the condition of the dam and monitoring the wet area along the toe; control trespassing on the slopes of the dam; provide a drain or other means for removing water collecting in the low level outlet chamber. In the near future: Reestablish and maintain grass and vegetation on the dam after repairs are made to the eroded areas on the downstream slopes; develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam; regularly monitor the condition of the wood decking and steel supports of the service bridge over the spillway and repair as required.

ANDERSON-NICHOLS & COMPANY, INC.

Warren A. Guinan

Warren A. Guinan, P.E.
Project Manager
New Jersey 16848

April 22, 1981

CLOVE LAKE DAM

OVERVIEW PHOTO

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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NATIONAL DAM SAFETY REPORT

CLOVE LAKE DAM FED ID NO. NJ00259

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
CLOVE LAKE DAM
FED ID NO. #NJ00259

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Clove Lake Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 12 December 1980 under Basic Contract No. FPM-39, and Contract No. A01093 dated 10 October 1979. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Company, Inc.

b. Purpose: The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Clove Lake Dam and appurtenances. Conclusions are based upon available data and visual inspection. The results of this study are used to determine any need for emergency measures and to conclude if additional studies, investigations, and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Clove Lake Dam is a 400-foot long earthfill dam with concrete and clay corewalls and a concrete spillway. The dam has a hydraulic and structural height of 11.4 feet and a width of 30 feet. A 24-foot roadway runs along the crest of the dam. The road bridge over the spillway has wooden guard rails. The bridge has a steel frame decked with wood plank. The spillway is an ogee weir with three stoplog bays. The spillway weir is 120 feet long. At the right end of the spillway is a box-type fish ladder. The dam has an upstream slope of 3H:1V and a 2H:1V downstream slope. Two 18-inch drawdown pipes, located in the right embankment, pass through a downstream valve box. An 8-inch AC pipe serves as a siphon and it is located to the right of the drawdown pipes.

b. Location. Clove Lake Dam is located on Shimers Brook, in Montague Township, Sussex County, New Jersey. The dam is at 41° 18.1' north latitude 74° 46.1' west longitude on the Milford, PA-NJ Quadrangle. The dam may be reached by driving

north on US Route 206 toward Montague, then turn right on Clove Road and travel northeast for approximately 1.5 miles to Holiday Lakes - Canyon Ridge Estates. The circumferential road around Clove Lake goes over the dam.

c. Size Classification. Clove Lake Dam is classified as being small in size on the basis of storage at the dam crest of 710 acre-feet, which is less than 1000 acre-feet, but more than 50 acre-feet, and on the basis of its height of 11.4 feet, which is less than 40 feet, in accordance with criteria given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Clove Lake Dam has no downstream hazard. It is therefore recommended that it be reclassified as low hazard. The spillway will pass the 100-year flood and is considered adequate.

e. Ownership. The dam is owned by Clubhouse Associates. For information, contact Mr. Gerald Roby, Clubhouse Associates, RD 4, Box 108, Montague, New Jersey 07827.

f. Purpose. The Clove Lake Dam was built for recreation.

g. Design and Construction History. Reproduceable plans revised and dated 1964 are available at NJDEP for Clove Lake Dam as prepared by Snook & Harden Engineers, Newton, NJ.

h. Normal Operational Procedure. No operational procedures were found for the dam.

i. Site Geology. Some limited geologic information (three boring logs) was available at the time the dam was inspected. The limited boring data from test holes No. 1 and No. 4 indicated that the site is comprised of several clay and gravel layers which are underlain by a deposit recorded as hard gravel. The borings were relatively shallow and did not penetrate any deeper than approximately 10 feet. Information derived from the Geologic Map of New Jersey (Lewis and Kummel, 1912) indicates that the soils within the immediate site consist of stratified drift which may consist of sand and gravel from plains, deltas, eskers, kames, or terraces.

The depth to bedrock at the dam site is unknown and outcrops were not observed during the dam inspection. The previously mentioned map indicates that bedrock in this area may consist of both dark coarse grained sandstone and black fissile shale overlying limestone.

1.3 Pertinent Data

a. Drainage Area

5.24 square miles from the Dam Application No. 551, filed 24 February, 1964. 5.6 square miles planimetered from latest USGS guadrangle maps.

b. Discharge at Damsite (cfs)

Maximum flood at damsite - unknown

Total ungated spillway capacity at maximum pool elevation (Top of dam) - 3586

c. Elevation (ft. above NGVD)

Top of dam - 619.1

Design surcharge - 617.6 (per dam application #551)
615.7 (100-year Stankowski discharge)

Recreation pool (at time of inspection) - 615.0

Spillway crest - 615.0

Streambed at centerline of spillway - 607.7

Maximum tailwater - 608.4

d. Reservoir (feet)

Length of maximum pool - 5100 (estimated)

Spillway crest - 5000

e. Storage (acre-feet)

Spillway crest - 289

Design surcharge - 350

Top of dam - 710

f. Reservoir Surface (acres)

Top of dam - 116

Spillway crest - 72

g. Dam

Type - earthfill with clay and concrete cores

Length - 400 feet

Height - 11.4 feet (hydraulic)

- 11.4 feet (structural)

Top width - 30 feet

Side slopes - upstream 3H:1V, downstream 2H:1V

Zoning - unknown

Impervious core - concrete and clay

Cutoff - unknown

Grout curtain - unknown

h. Spillway

Type - Ogee concrete, with fish ladder

Length of weir - 120 feet

Crest elevation - 615 feet NGVD

Low level outlet - See Item i below

U/S Channel - Clove Lake

D/S Channel - Shimers Brook

i. Regulating Outlets

Type - Two 18-inch CI pipes; 8-inch AC pipe siphon

Length (estimated) - 18-inch CIP's - 80 feet
upstream inlets not observed,
pipes are 3.5 feet center to
center.
8-inch AC pipe - 65 feet

SECTION 2
ENGINEERING DATA

2.1 Design

Some hydraulic, hydrologic, and other engineering design data were disclosed. This information is available at NJDEP, P.O. Box CN-029, Trenton, N.J. 08625 and copies of the legible information is included in Appendix 1 of this report.

2.2 Construction

No recorded data concerning actual construction of Clove Lake Dam were discovered.

2.3 Operation

The dam was apparently operated and inspected regularly until 1971. No data pertaining to the recent operation of the dam were found.

2.4 Evaluation

a. Availability. A search of the New Jersey Department of Environmental Protection Files, contact with community officials revealed adequate information. Copies of the legible pages are included in Appendix 1 of this report.

b. Adequacy. The visual inspection verified available information which is deemed adequate to complete this Phase I Inspection Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. Dam. Trees are growing on the upstream slope to the right of the spillway and on the downstream slope on both sides of the spillway. Considerable erosion has taken place on the upstream slope at and above the waterline. The appearance of small boulders and gravel at and below the waterline may be the result of fines being washed out of the embankment material by wave action thereby resulting in the coarse gravel fraction covering the slope.

The crest of the dam is partially covered with grass. A 24-foot wide asphalt roadway along the axis of the embankments form the approaches to a wood decked service bridge over the spillway that is 30 feet wide.

The downstream slope to the left of the spillway has a large erosion gully approximately 8 feet wide and 2 feet deep adjacent to the spillway wingwall. Except for one 6-inch diameter tree growing near the spillway wingwall, the remainder of the slope is grass covered with an area of brush growing adjacent to the discharge channel.

To the right of the spillway, the downstream slope is covered with brush, gravel, small boulders, and several hay bales which make it difficult to inspect the downstream slope adequately. Several erosion gullies, which are bare of vegetation, extend from the crest to the downstream toe. The area at the downstream toe of the dam is generally wet and soft and contains an extensive growth of wetlands type vegetation. Ponded water was observed along the downstream toe but no flowing water was noted. The downstream pond is in contact with the downstream toe near the low-level concrete outlet. An 8-inch diameter asbestos cement pipe was exposed on the downstream slope approximately six feet down from the dam crest. The pipe appears to pass through the dam below the asphalt pavement to an inlet located on the upstream slope. According to the owner, the pipe has been used as a siphon to remove water from the reservoir. It appears the outflow from the pipe would discharge on the slope during operation.

b. Appurtenant Structures. The entrance to the ungated spillway was relatively free of debris at the time of the inspection. Many boulders which were partially covered by brush and weeds were observed on the bottom of the discharge channel downstream from the spillway crest.

(1) Spillway. The concrete fish ladder at the left end of the spillway is badly eroded and deteriorated with reinforcing steel exposed. Concrete surfaces around the stoplog slots are eroded. One section of the downstream apron is eroded. A 3-foot long section of the main spillway crest near the left center is spalled to a depth of approximately 3 inches. All stoplogs are badly weathered and some of the steel stoplog supports are bent.

(2) Service Bridge. The wooden deck was observed to be weathered and worn from traffic. The upstream steel columns are rusting at the waterline.

(3) Low Level Outlet. The concrete valve chamber is located on the downstream face of the dam and is in fair condition. The pipes on the valve chamber were covered with water. The valves were not operated at the time of inspection; however, they appeared to be in operable condition.

c. Reservoir Area. The watershed above the lake is gently sloping, wooded and contains numerous homes. Slopes on the shore of the lake appear stable. No evidence of significant sedimentation was observed.

d. Downstream Channel. Erosion has occurred on the right and left banks of the channel immediately downstream of the spillway for a distance of approximately 100 to 150 feet where it joins a pond downstream from the dam. Many small boulders are located on the channel bottom. Shimers Brook discharges into what appears to be a man-made lake downstream of Clove Lake Dam about 0.5 mile. Although no homes are presently constructed around this downstream water body, it appears that there may be construction in the future.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No recent formal operating procedures were disclosed. However, some record was found of past operating procedures. (See Appendix 1)

4.2 Maintenance of Dam

No recent maintenance procedures for the dam were found.

4.3 Maintenance of Operating Facilities

No formal maintenance procedures for the operating facilities were disclosed.

4.4 Warning System

No description of any warning system was disclosed.

4.5 Evaluation of Operational Adequacy

Because of the lack of operation and maintenance procedures, the remedial measures described in Section 7.2 should be implemented as prescribed.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. Design Data. The design data available included hydrologic determinations and spillway and dam hydraulics and stability analyses which were useful as a base for the analysis in this report.

b. Experience Data. Experience data found in annual inspection reports revealed that the dam has not been overtopped. No other experience data was disclosed. (See Appendix 1)

c. Visual Inspection. The upstream inlets for the two 18-inch low-level outlets were not visible. The valves for both are located in a valve box on the downstream embankment. The outlets are probably in the pond at the edge of the right embankment. The discharge over the weir was confined to two of the stoplog bays. The inlet to the 8-inch asbestos cement (AC) siphon pipe is located approximately 6 feet below the dam embankment. The outlet appears to discharge directly onto the lower portion of the earth embankment although no evidence of such discharge was observed. Wetlands type plants and pooled water are located at the toe of the dam. It is unknown whether these features are a result of seepage or back-up from the pond just downstream. Brush and a few small trees are growing on the downstream embankment and toe area.

d. Clove Lake Dam Overtopping Potential. The hydraulic/hydrologic evaluation for the dam is based on a selected Spillway Design Flood (SDF) equal to the 100-year flood in accordance with the range of test floods given in the evaluation guidelines, for dams classified as low hazard and small in size. The 100-year flood discharge was determined by Stephen J. Stankowski's method as outlined in "Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization", Special Report #38, 1974. Hydrologic computations are given in Appendix 3. The 100-year discharge for the subject watershed is 581 cfs. The spillway can pass the 100-year flood without overtopping the dam embankment and is considered adequate.

e. Drawdown Capacity. Assuming the two low-level outlets currently in place are in operable condition, it is estimated that the lake can be drained in approximately 8 days assuming no significant inflow. This time period is considered marginal, but adequate, for draining the reservoir in an emergency situation.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

The presence of a dense growth of brush, grass, boulders, several bales of hay, and coarse weeds on the downstream slope of the embankment to the right of the spillway make it difficult to make an adequate visual inspection of the toe and much of the embankment.

The soft and wet area along the downstream toe of the dam may be indicative of seepage either through or under the dam which, if not properly controlled, could lead to failure of the dam by piping or sloughing of the downstream slope. The existence of the adjoining small pond makes it difficult to determine whether the standing water at the downstream toe is a result of seepage or the low elevation relative to the elevation of this downstream pond.

Erosion on the downstream slope of the dam, if allowed to continue, could result in eventual breaching of the embankment. The erosion at and above the waterline on the upstream slope of the dam, if allowed to continue, could result in eventual breaching of the embankment. If water were to discharge from the 8-inch diameter asbestos cement siphon pipe near the center of the dam, it may cause erosion and sloughing of the downstream slope of the dam. Trees growing on the downstream slope may cause seepage and erosion problems if a tree blows over and pulls out its roots, or if a tree dies or is cut and the roots rot. The location of low-level outlet pipe valves on the downstream face of dam is undesirable because of having pipes under pressure, which, should they rupture, upstream of the valves could severely damage or cause breaching of the dam.

The 1964 stability analysis included in Appendix 1 was reviewed. The analysis follows generally accepted procedures for overtopping and sliding resistance and the assumptions seem reasonable. It was noted that loading due to ice conditions on the piers of the bridge and vacuum caused by flow over the spillway were neglected.

6.2 Design and Construction Data

All legible design or construction data pertinent to the structural stability of the dam are included in Appendix 1.

6.3 Operating Records

No operating records pertinent to the structural stability of the dam were available.

6.4 Post-Construction Changes

No record of post-construction changes was available.

6.5 Seismic Stability

This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist." None of the visual observations made during the inspection are indicative of unstable slopes. However, because no data are available concerning the engineering properties of the embankment and foundation materials for this dam or the condition at the base of the core wall, it is not possible to make an engineering evaluation of the stability of the slopes or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Clove Lake Dam is 17 years old and is in fair condition.

b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the results of the visual inspection

c. Urgency. Because the dam poses no hazard to life and little hazard to property at this time, there is little urgency to implement the recommendations in Section 7.2 based on safety considerations alone. Should the owner wish to maintain the dam embankment the recommendations should be implemented as prescribed. In the future, should development occur around the large pond downstream, the hazard classification should be re-evaluated at that time.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2.a. These problems require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to failure of the dam.

7.2 Recommendations/Remedial Measures

a. Recommendations.

The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following in the time periods specified.

Starting soon:

(1) Conduct a structural stability analysis of the spillway including consideration of loading from ice and vacuum.

(2) Design or specify repairs for the erosion of the upstream slope of the dam and design or specify erosion protection for the upstream slope of the dam.

(3) Design and oversee procedures for the removal of trees and brush from the downstream slope and at the downstream toe of the dam.

(4) Investigate the need for leaving the 8-inch diameter AC pipe in place and design a satisfactory outlet for the pipe, if this siphon is required.

(5) Design and oversee repairs for the eroded areas on the downstream slope of the dam.

(6) Investigate the cause of the wet and soft areas at the toe of the dam and design remedial measures, if required.

In the near future:

(1) Design and oversee procedures to repair the concrete spillway and fish ladder, and the stoplog facilities.

(2) Relocate the gate valve box for the twin 18-inch draw-down pipes to place the valves on the upstream side of the dam.

b. Operating and Maintenance Procedures.

The owner should accomplish the following beginning soon:

(1) Start a program of periodically checking the condition of the dam and monitoring the wet area along the toe.

(2) Control trespassing on the slopes of the dam.

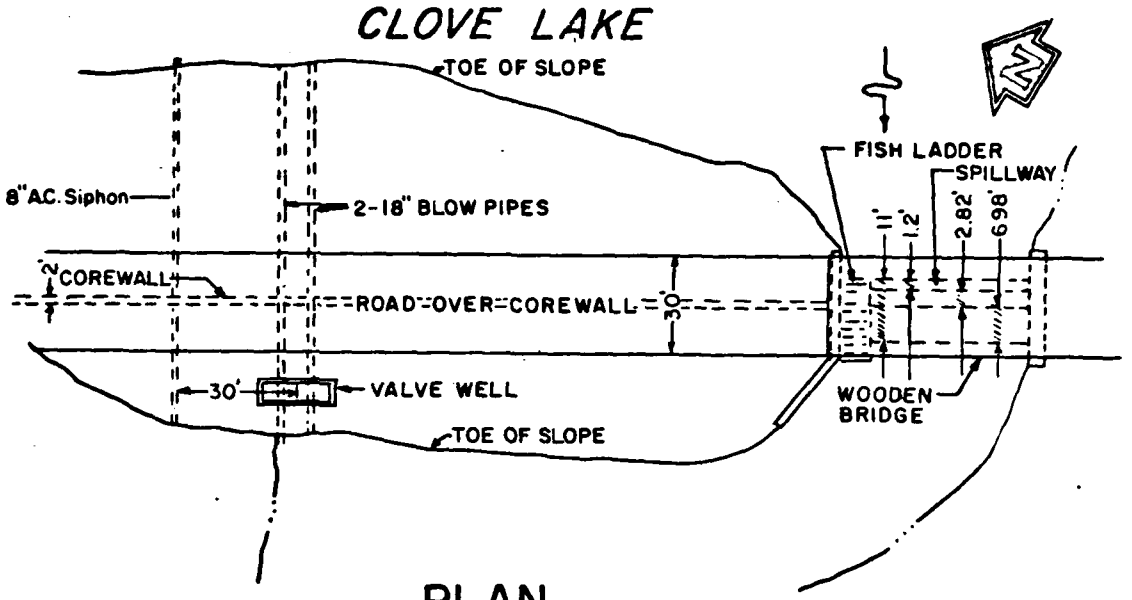
(3) Provide a drain or other means for removing water collecting in the low-level outlet chamber.

In the near future:

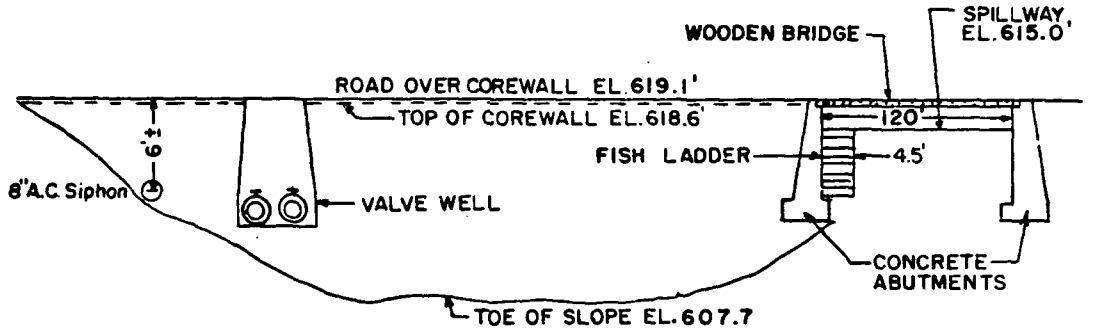
(1) Reestablish and maintain grass and vegetation on the dam after repairs are made to the eroded areas on the downstream slopes.

(2) Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

(3) Regularly monitor the condition of the wood decking and steel supports of the service bridge over the spillway and repair as required.



PLAN



ELEVATION

Anderson-Nichols & Co, Inc. BOSTON MASSACHUSETTS	U.S. ARMY ENGINEER DIST PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
CLOVE LAKE DAM	
SHIMERS BROOK NEW JERSEY	
	SCALE NOT TO SCALE
	DATE JUNE 1981

FIGURE-1

Anderson-Nichols & Co., Inc. BOSTON MASSACHUSETTS	U.S. ARMY ENGINEER DIST. PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

CLOVE LAKE DAM
LOCATION MAP

SHIMERS BROOK NEW JERSEY

SCALE: 1" = 4 Miles Approx.

DATE: JUNE 1981

SCALE IN MILES

0 4 8

MAP BASED ON STATE OF NEW JERSEY OFFICIAL MAP & GUIDE.

FIGURE -1

APPENDIX 1

ENGINEERING AND EXPERIENCE DATA

CLOVE LAKE DAM

AIA
NSPE

CRAIG P. HAAGEN ARCHITECT-ENGINEER

[redacted]

July 3, 1973

N. J. Department of Environmental Protection
Director Water Resources
P. O. Box 1390
Trenton, N. J. 08625

Attention: Mr. Kirk G. Hoffman, P. E., Chief, Bureau of Water Control

Subject: Clove Dam, Montague, N. J.
Application No. 551

Gentlemen:

In accordance with your notice to Mr. Henry E. Walster, Holiday Lake, Inc. dated January 22, 1973, enclosed please find the annual report 1973 covering the above subject Application.

The attached photos were taken at the site June 1h, 1973. Photos taken on February 19, 1973 unfortunately, were exposed and prints could not be made.

The dam was found in good condition and no current repairs are indicated.

Very truly yours,

Craig P. Haagen

CPH:bg

...dition Report - Dam

Action No. [redacted]

Built 1963 (completed)

...e of Dam Glove Dam, Montague, N. J.

Dam Inspected 2-19-73
6-14-73

Owner's Name Holiday Lake, Inc.

Address R.D. #1, Port Jervis, N. J. 12771

Description of condition of the following:

1. Embankment (Erosion, seepage, etc) *

No change, Good condition

2. Spillway (Concrete spalling, timber rotting, leakage, etc.)

Good condition

3. Emergency Spillway (Erosion, growth of sod, trees, etc.)

Is incorporated with fish ladder and weir - Satisfactory
By Pass valve operable

4. Outlet Works (Operational condition of valves or gates, condition of pipe, etc.)

Used Spring 1973 - operated satisfactorily

5. Inlet Stream (Silt deposition, etc.)

Running clear - no deposits

6. Outlet Stream (Scouring, undercutting of dam, condition of stilling basin, etc.)

Good condition

7. General

a. Did flood waters overtop dam during period of report? Not to date.
If so, at what stage and date thereof.

b. Report on any other condition not covered above.
None

c. In your opinion, does existing condition warrant repairs? None
If so, where and to what extent.

d. Photographs of the upstream and downstream faces of the embankment, main spillway and emergency spillway noting date taken. Attached.

Use additional sheets when necessary.

Inspected by, [signature]

Consulting Engineer Craig P. Hearon, P. E.

N. J. License No. 5774

Date: July 3, 1973

SAA

January 22, 1973

Mr. Henry E. Walster
Holiday Lake, Inc.
R.D.#1
Port Jervis, NY 12771

Re: Clove Dam
Application No. 551

Dear Mr. Walster:

Please arrange to submit an annual report on the condition of the Clove Dam and appurtenances as required by Condition No. 10 to the permit approved April 21, 1962 by this Division. The report should reach this office within four months from the date of this letter.

A report form is enclosed for your convenience.

Very truly yours,

Dirk C. Hofman, P.E.
Chief, Bureau of Water Control

SAA:mp
Enclosures

Report received.
SAA
7/10/73

SAH

Arnold H. Hevert, P. E.

CONSULTING ENGINEER

Post Office Box [illegible] · [illegible], N. J. [illegible] · ([illegible]) [illegible]

December 14, 1971

Re: Clove Dam
Application No. 551

State of New Jersey
Dept. of Environmental Protection
Division of Water Policy and Supply
Box 1390
Trenton, N.J. 08625

RECEIVED
DEC 15 10 23 AM '71
DEPT. ENVIR. PROTECT.
DIV. OF WATER RESOURCES

Att: Mr. Robert L. Hardman, P.E.
Chief, Bureau Water Control

Gentlemen:

Please find attached the annual report for the year 1971 covering inspection of Clove Dam, located at Holiday Lake, Montague Township, Sussex County, N.J.

Photographs taken show the condition downstream of the spillway after correction of the eroded condition beyond the spillway apron.

In the opinion of the writer this dam is now in good condition and no actual repair work is needed.

This report was delayed by the writer to insure that replacement of eroded soil downstream of the spillway was satisfactorily corrected. This has been accomplished to the writer's satisfaction.

Thank you.

Very truly yours

Arnold H. Hevert

Arnold H. Hevert, P.E.

AHH:jd
Enc.
cc:HMulster

RECEIVED
Dec 15 10 20 AM '71
DEPT. ENVIR. PROTECT.
DIV. OF WATER RESOURCES

CONDITION REPORT - DAMS

Application No. 551
Name of Dam - Clove Lake
Owner's Name - Holiday Lake Inc.
Address c/o Henry E. Wulster
RD #1 Port Jervis, N.Y. 12771

Description of condition of the following: Year: 1971
Date of Inspection
October 3, 1971

1. Embankment (Erosion, seepage, etc)

No seepage through embankment
Downstream erosion repaired. Earth eroded was replaced by earth movers

2. Spillway (Concrete spalling, timber rotting, leakage, etc)

(a) Spillway in good condition
(b) Timber in good condition
(c) No leakage through spillway

3. Emergency spillway (Erosion, growth of sod, riprap, etc)

Emergency spillway - good condition
Spillway apron repaired and in good condition
No leakage in evidence at time of inspection

4. Outlet Works (Operational condition of valves or gates, Condition of pipe, etc).

Examination: All outlet works functional and in good condition

5. Inlet streams (Silt deposition, etc)

No silting or displacement - two inspected and okay

6. Outlet stream (Scouring, undercutting of dam, condition of stilling basin, etc).

Scouring and undercutting downstream of dam was repaired back to original and is now satisfactory.

7. General

a. Did flood waters overtop dam during period of report? If so, at what stage and date thereof.

No overtopping

b. Report on any other condition not covered above.

None

e. In your opinion does existing condition warrant repairs?

Repairs were instituted prior to final inspection - Erosion downstream filled in as original

d. Photographs of the upstream and downstream faces of the embankment, main spillway and emergency spillway noting date taken.

Use additional sheets when necessary.

Inspected by:

Consulting Engineer Gerard H Hunt

N.J. License No. 5888

Date: December 13, 1971

Inspection Made: October 3, 1971

ANNUAL REPORT - DAMS

For Year 1970

Application No. 951

Date of Inspection Oct 10

Name of Dam Clove Dam - Montague, N.J.

Owner: Name Holiday Lake Inc. c/o Frederick deWitte, Pres.

Address 120 Pleasant Ave.

Upper Saddle River, N.J.

Description of condition of the following:

1. Embankment (Erosion, seepage, etc.)

a. Minor scouring below spillway on western end where rip rap starts below discharge apron.
b. No seepage through embankment

2. Spillway (Concrete spalling, timber rotting, leakage, etc.)

a. 3 step concrete spillway shows no deterioration
b. No timber rotting - fish ladder OK
c. No leakage through dam or spillway

3. Emergency Spillway (Erosion, growth of sod, riprap, etc.)

a. Combined continuous concrete dam with spillway in good condition. No. spalling
b. Vertical concrete construction joints satisfactory

4. Outlet Works (Workability of Valves, gates, condition of pipe, etc.)

Auxiliary level control valve greased and operable. Screen cover inlet pipe underwater. Outlet pipe OK
Wood spillway timbers OK

5. Inlet Stream(s) (Silt deposition, etc.)

Inspected (1) inlet stream and found no silting or deposit at outfall. Southernmost stream inlet from pond requires safety screen.

6. Outlet Stream (Scouring, undercutting of dam, etc.) Condition of still.

Minor scouring per item 1 above. No undercutting.

7. General.

a. Did flood waters overtop dam during period of report? If so, at what stage and date thereof.

a. Dam overtopped from Jan. to end of June 1970.

b. Report on other conditions not covered above.

Water level measured at 26" below top of dam on date of this inspection

c. In your opinion, does existing condition warrant repairs? If so, where and to what extent.

Not at this time. Covers should be replaced for level control valve at dam and zone inlet southernmost inlet stream.

d. Submit photographs of the upstream and downstream faces of the embankment, main spillway and emergency spillway, showing date taken.

Annual Report - Dams

Page 1

Application No. 551 For year: 1968

Name of Dam Clove Dam Date of Inspection: 11/8/68

Owner, Name Holiday Lake Inn c/o Mr. Frederick DeNitto, Pres
120 Pleasant Ave.
Address Upper Saddle River, N.J.

RECEIVED
FEB 6 '69

Description of condition of the following:

1. Embankment (Erosion, seepage, etc.)
   a. Minor erosion of embankment on downstream face. Under repair
   b. No seepage through embankment. No surface seepage through embankment
2. Spillway (Concrete spalling, timber rotting, leakage, etc.)
   a. Three step concrete spillway shows no deterioration
   b. No timber rotting
   c. No apparent leakage through spillway
3. Emergency Spillway (Erosion, growth of sod, riprap, etc.)
   a. Combined & continuous concrete dam structure with spillway (item 2 shows no spilling.
   b. Erosion rip rap off spillway apron repaired or replaced
   c. Two vertical surface cracks top to bottom no evidence of leaks grouted
4. Outlet Works (Work ability of valves, steel condition of pipe) etc.)
   a. Twin valves appear function. Reported used.
   b. No gates in system
   c. Outlet pipes (2) under water & not visible
5. Inlet stream(s) (Silt deposition, etc.)
   Two (2) inlet streams inspected & found satisfactory with no silting or appreciable displacement.
6. Outlet stream (Scouring, undercutting of dam, etc.) Condition of stilling basin, if any.
   a. Evidence of stream scouring to swamp 200' below dam, under repair.
   b. No apparent undercutting of dam. c. stilling basin is natural swamp
7. General

a. Did flood waters overtop dam during period of report. If so at what stage and date thereof
   a. spilling overtopped during spring & early summer 1968 embankment not overtopped.
b. Report on other condition not covered above.

c. In your opinion, does existing condition warrants repairs? If so where and to what extent
   a. Item 3c above - surface concrete temperature hairline cracks to be grouted. No leakage, not considered serious problem
   b. Riprap and outfall of dam has been regraded but is unfinished will be regraded during summer of 1969

d. Submit photographs of the upstream and downstream faces of the embankment, main spillway and emergency spillway noting date taken

Photo enclosed

Plat #1 - Photo #1 Hairline cracks downstream face of spillway
Photo #2 Fish ladder, general view, condition good

Plat #1 - Photo #1 Downstream view of spillway and bridge
Photo #2 Close up view of downstream side of spillway
Photo #3 View of spillway in progress of regrading
Photo #4 View of spillway in progress of regrading

Plat #3 - Photo #1 Downstream side of west side of dam, overburden
Photo #2 View of valve box downstream, condition good

Plat #4 - Photo #1 North view of lake from embankment
Photo #2 Westerly view of upstream side of dam beach and protective fencing shown
Photo #3 - same as photo #2
Photo #4 Downstream side of dam taken from westerly side

Plat #5 - Photo #1 View of downstream side of dam showing repair made to hairline cracks
Photo #2 Same as above, closer view

HOLIDAY LAKE, INC.

150 Pleasant Avenue
U. SADDLE RIVER, N. J.
07458
201-327-3378

DIVISION OF
WATER POLICY AND SUPPLY

January 11, 1968

Mr. George R. Shanklin, Director and Chief Engineer
Division of Water Policy and Supply
P. O. Box 1390
Trenton, New Jersey 08625

Re: Clove Lake Dam Application No. 551

Dear Mr. Shanklin:

Please be advised that we have just recently entered into a contract with Zitone Construction Company of Montague, New Jersey, for the repair of the spillway.

This repair work, of course, will be completed as soon as the cold weather abates and weather permits.

We will let you know the minute the work has been completed.

Very truly yours,

HOLIDAY LAKE, INC.

Henry E. Wulster

HEW:RM

Annual Report - Dam

Application No. 551 For year: 1967

Name of Dam Clove Dam Date of Inspection: 7/22/67

Owner, Name Holiday Lakes, Inc., c/o Mr. Frederick DeMitte, Pres.

Address 120 Pleasant Ave.

Upper Saddle River, N. J.

Description of condition of the following.

1. Embankment (Erosion, seepage, etc.)
   a. Minimal evidence erosion of overburden placed on embankment on downstream face.
   b. No apparent seepage through embankment.

2. Spillway (Concrete spalling, timber rotting, leakage, etc.)
   a. Three-step concrete spillway shows no evidence of spalling.
   b. Timber rotting not applicable.
   c. No apparent leakage through spillway.

3. Emergency spillway (Erosion, growth of sod, riprap, etc.)
   a. Combined and continuous concrete structure with spillway (item 2) shows no evidence of spalling. b. Erosion, growth of sod, riprap, not applicable.
   c. Two (2) vertical cracks top to bottom; one crack has minimal evidence leakage; other crack no evidence leakage.

4. Outlet works (Trash racks, valves, gates, Condition of pipes, etc.)
   a. Twin valves appear operable.
   b. No gates in system.
   c. Outlet pipes (2) under water and could not be inspected.

5. Inlet stream (s) (Silt deposition, etc.)
   Two (2) inlet streams have no appreciable silt deposition.

6. Outlet stream (Scouring, undercutting of dam, etc.) Condition of stilling basin, if any.
   a. Minimum evidence stream scouring below dam 200 ft.² to swamp.
   b. No apparent undercutting of dam.
   c. Stilling basin is natural downstream swamp.

7. General
   a. Did flood waters overtop dam during period of report?
      If so, at what stage and date thereof.
      Entire spillway overtopped during heavy rains Spring, 1967; embankment not overtopped.

   b. Report on any other condition not covered above.

   c. In your opinion, does existing condition warrant repairs?
      If so, where and to what extent.
      1. (item 3) Two (2) vertical cracks emergency spillway should be repaired.
      2. (item 6) Owner intends to rechannel outlet stream to swamp area.

Clove lake

Form 15-SC-6-59

Dam Application No. 553
Map No. 21-56

State of New Jersey
Division of Water Policy and Supply

REPORT ON DAM APPLICATION

Application of HOLIDAY LAKE, INC., ROUTE 3., HAVERT, N. J.

filed FEB. 24, 1964 for approval of plans and for a permit to CONSTRUCT

a dam for the impoundment of CLOVE LAKE across SKINNER BROOK

tributary to DELAWARE RIVER in MONTAGUE TOWNSHIP

SUSSEX County, New Jersey, has been examined by E. A. WEBSTER
SUPERVISING ENGINEER

PRINCIPAL FEATURES

Purpose of dam	Development	Type of dam	Earthfill, clay and concrete cores	
Site inspected		Foundation material	Clayey Gravel	
Location	S1-S-7-9-5	Maximum height	24	feet
Drainage area	5.8	sq. mi.	Length of dam	420	feet
Elevation of flow line	101.50	Top width of dam	30	feet (roadway)
Area of lake	9100	acres	Downstream slope	2:1
Capacity of lake		million gallons	Upstream slope	3:1
Type of spillway	Concrete, Ogee Section			
Length of spillway	120 ft.			
Design flood flow	1810	cubic feet per second =	345	cu. ft. per sq. mi.
Head on spillway for design flood flow	5.62ft			
Freeboard	1.50	feet		
Maximum spillway capacity (dam overt) =	3515	cubic feet per second		
	=	604	cu. ft. per sq. mi.	
Outlet other than spillway	8-18" gated pipes			
Drawings filed by	W. J. Hardin, Smock & Hardin, Newton, N.J.			

Clove Lake

PERTINENT INFORMATION -

Original permit for construction of this dam was issued April 2, 1914 to Clove Lake Enterprises. Plans and permit in this folder.

Revised plans show the following revisions:

1. Earthfill section enlarged to accommodate a 30-foot roadway on dam crest;
2. Dam and spillway raised 6.60 feet and 6.50 ft. respectively;
3. Spillway lengthened 70 feet; bridge to span spillway;
4. Ogee spillway section slightly enlarged
5. Other "automatic" changes such as larger and deeper lake and longer blow-off pipe lines.

Clove lake

It has been found that the site for the dam is suitable and the plans adequate to insure the construction of a structure which will not be a menace to life or property under design flood conditions. It is therefore recommended that the plans be approved and that a permit be issued subject to standard conditions and to the following special conditions:

Drawings showing revisions to original approved plans and approved herewith are:

"Plan of Dam for Clove Lake"

"Cross-Sections of Dam for Clove Lake"

Untitled drawing showing

Section Thru East Wingwall Spillway
Section Thru West Wingwall Spillway
Section of Spillway at East Wingwall

Chief, Bureau of Water Control

Chief Engineer

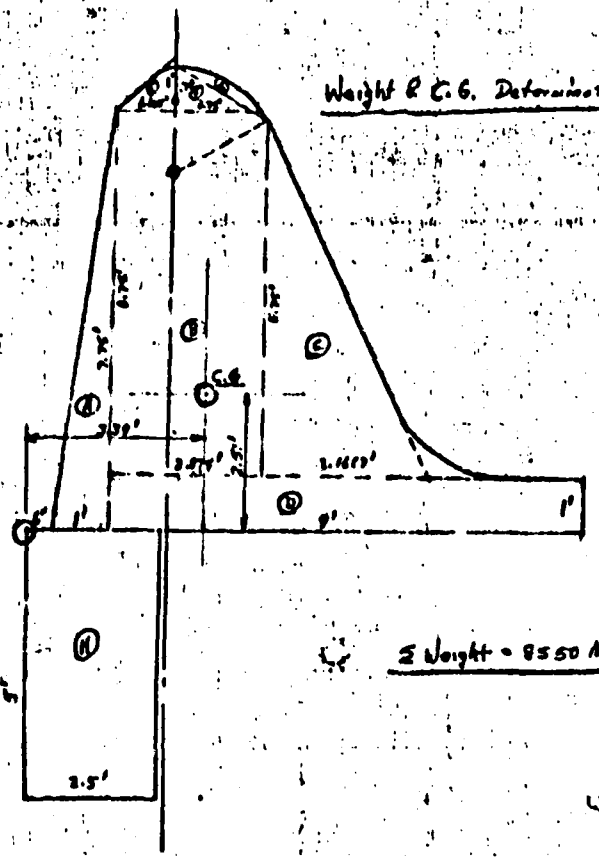
Trenton, New Jersey

April 1 , 19 46

Clover lake
Spillway weight

BY KHM DATE 2/2/15 SUBJECT CLOVER LAKE DAM #631 SHEET NO. 1 OF
CHKD BY DATE SPILLWAY SECTION JOB NO.
Revised Scale 1" = 1'-0"

Weight & C.G. Determination



Σ Weight = 8550 lbs.

3/30/64
Elm

Dam 551

Spillway Hydraulics

$Q_{50} = 1810$ cfs

$Q = CLH^{3/2}$

$C = 3.60$

$L = 120$ ft.

12" H-columns neglected

$H^{3/2} = \frac{1810}{120 \times 3.6} = 4.19$

$H = 2.60$ ft.

Elev. top of dam = 105.60

Elev. spillway crest = 101.50

4.10

H = 2.60

1.50' freeboard

OK

Emergency @ Elev. 105.60

H = 4.10

$Q = 3.60 \times 120 \times 8.302 = 3585$ cfs

684 acres

Clove lake
Spillway determ...

Dam 551 (Revised) 3. 3/?/69 RW

Spillway Section, Stability Analysis

See attached sketch

Forces Acting on Section

Water, at Flood stage

$H = 2.60'$

$+ 8.50$

$h = 11.10$

$wh = 11.10 \times 62.5 = 694$

$P = \frac{694 \times 11.10}{2} = 3855$ lbs

$z = \frac{11.10}{3} = 3.70$

$P_{TW} = \frac{62.4 \times 1^2}{2} = 32^{\#}$

62.5

1.34'

$W_1 = 62.5\left(\frac{1 \times 7.7}{2} + 1 \times 3.4\right) = 62.5\,(7.25) = 453$

$W_2 = 62.5\left(\frac{0.5 \times 11.10}{2}\right) = 62.5\,(2.78) = 173.7$

Earth Pressures (Dry foundation)

$w = 70$ #/ft³

$\phi = 30°$ $h = 5$ ft.

$P = \frac{w K h^2}{2}$

Passive pressure coefficient = 3.0

cohesion = 0

$P_E = \frac{70 \times 3.0 \times 25}{2} = 2625^{\#}$ Cd "Section H"

$70 \times 30 \times 5 = 70 \times 15 = 1050^{\#}$

$\frac{5}{3} = 1.67'$

Clover Leaf Spillway Weigh

Pressure on "Sect. ②", Tailwater:

$P = \frac{110 + 3.0 + 1}{2} \cdot \frac{330}{2} = 165^{\#}$

$wh_p h = 330^{\#}$

$x = \frac{1}{2} = .34$ ft.

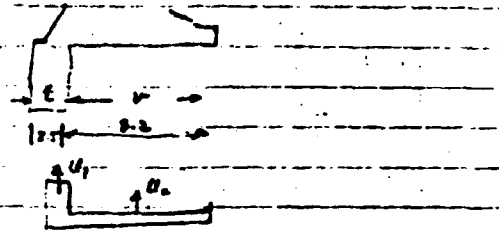
Uplift Pressure

Assuming Tailwater at 1 ft. depth.

and $w = 70$

$H = 16.16$ ft

$h_2 = 1.0$ ft.



$U_1 = wHt = 70 \times 16.16 \times 2.5 = 2820^{\#}$

$U_2 = wh_2 w = 70 \times 1 \times 8.2 = 574^{\#}$

$\Sigma U = 3394^{\#} = U_s$

Clove lake

Factor of Safety Against Overturning

$$FS = \frac{M_R}{M_o}$$

$$\Sigma M_o = (3855 \times 3.70) + (173.7 \times .25) + (453 \times 1)$$
$$14250 + 43.4 + 453 = 14746$$

$$\Sigma M_R = (2625 \times 3.34) + (165 \times 0.24) + (32 \times 1.34) + (8550 \times 3.39)$$

$$8577$$
$$56$$
$$43$$
$$29000$$
$$M_R = 37676$$

$$FS = \frac{37676}{14746} = 2.55$$

OK

Clove Lake

Resultant of Forces

$\tan \theta = \frac{\Sigma P}{\Sigma W} = \frac{3855}{8550} = 0.451$

$\theta = 24.2°$ $\sin \theta = .4115$

$R = \frac{3855}{.4115} = 9365^{\#}$

$3.70 \times .451 = 1.67'$

3.39

$5.06'$ distance from O

∴ Resultant cuts base within middle third.

OK

Resistance to Sliding

Friction force $= \mu(\Sigma N + P - U)$

$\mu = .33$ $P = (3855 + 2(25 \times 110)) = 6855$

$\Sigma N = 8550$ $U = 3294^{\#}$

$F_f = .33(8850) = 3908$

$FS = \frac{3908}{3855} = 1.01$

satisfactory

Clove lake

3/3/64

Spillway Section
Weight & Center of Gravity Determination

Section	Wt = L	Area	"X"	AX	"Y"	AY
A	$\frac{1 \times 7.75}{2}$	3.875	1.170	4.532	2.250	8.720
B	2.875×6.75	19.406	2.937	57.000	4.375	85.000
C	$\frac{3.1667 \times 6.75}{2}$	10.687	5.431	58.020	3.250	34.750
D	1×9	9.000	6.000	54.000	0.500	4.500
E	$\frac{1 \times 1.125}{2}$	0.563	2.250	1.266	8.090	4.558
F	$\frac{.75 \times 1.75}{2}$	0.656	3.209	2.100	9.000	5.250
G	negligible.					
H	2.5×5	12.500	1.250	15.625	−2.50	−31.250
		56.687		192.543		174.020
						31.250
						142.770

$$\bar{X} = \frac{192.543}{56.687} = \frac{193}{57} = 3.39' \quad (3'-4\tfrac{7}{8}")$$

$$\bar{Y} = \frac{142.770}{56.687} = \frac{143}{57} = 2.51' \quad (2'-6\tfrac{1}{8}")$$

Weight = 57 × 150 = 8550 lbs.

Clove Lake Spillway weight

2/20/64
RBW

Acc 557 Clove Lake Dam, Penrick

Hydrologic Determinations

Design Flood

Drainage Area 5.24 sq miles

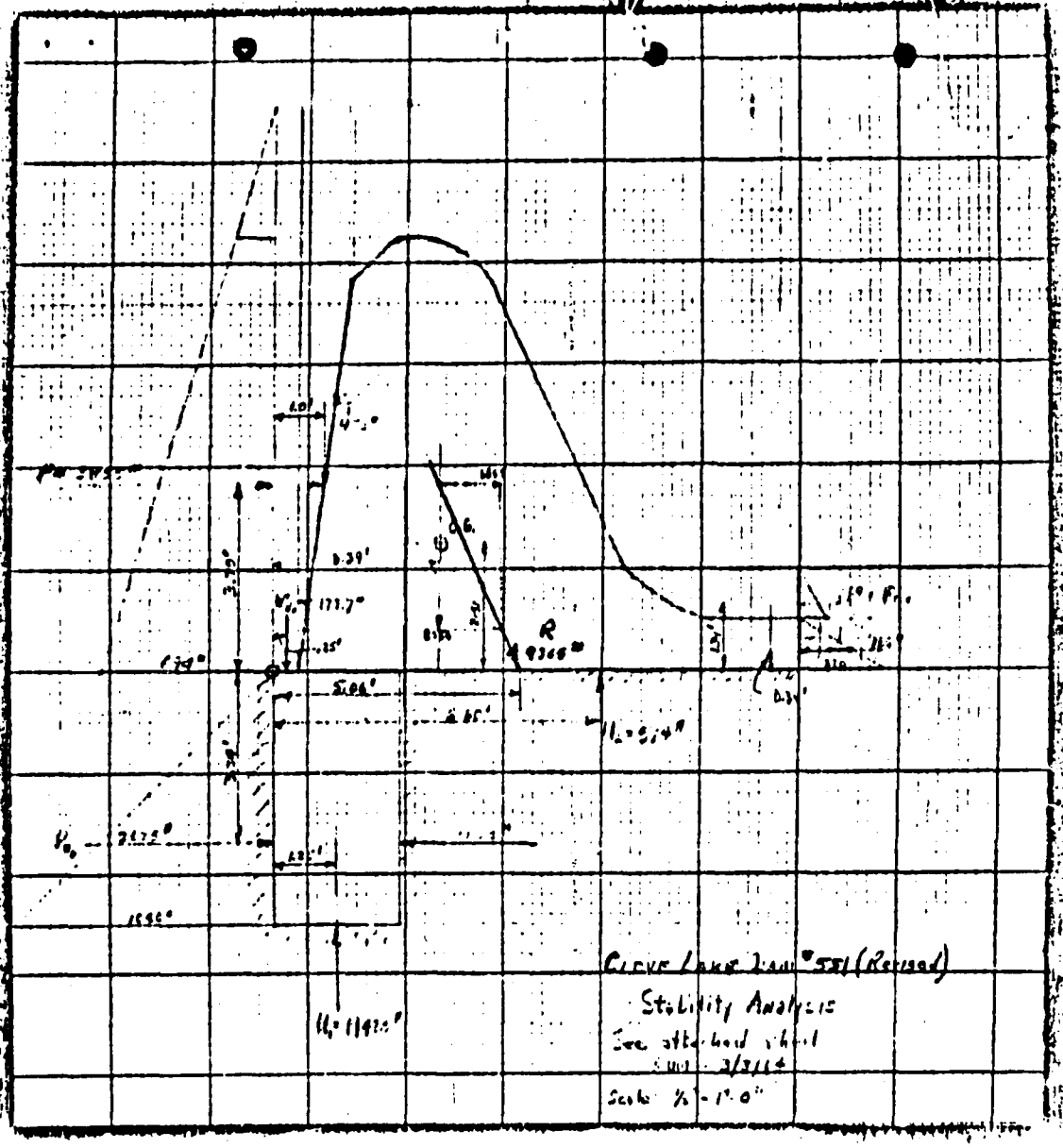
Central Jersey Curve = 175 csm
North Jersey " = 400 csm
575
287.5 = Mean

$Q_{50} = \frac{575}{2} \times 1.20 = 345$ csm

$Q_{50} = 345 \times 5.24 = \underline{1810}$ cfs

Clove Lake Flood
design

Clovelake Spillway



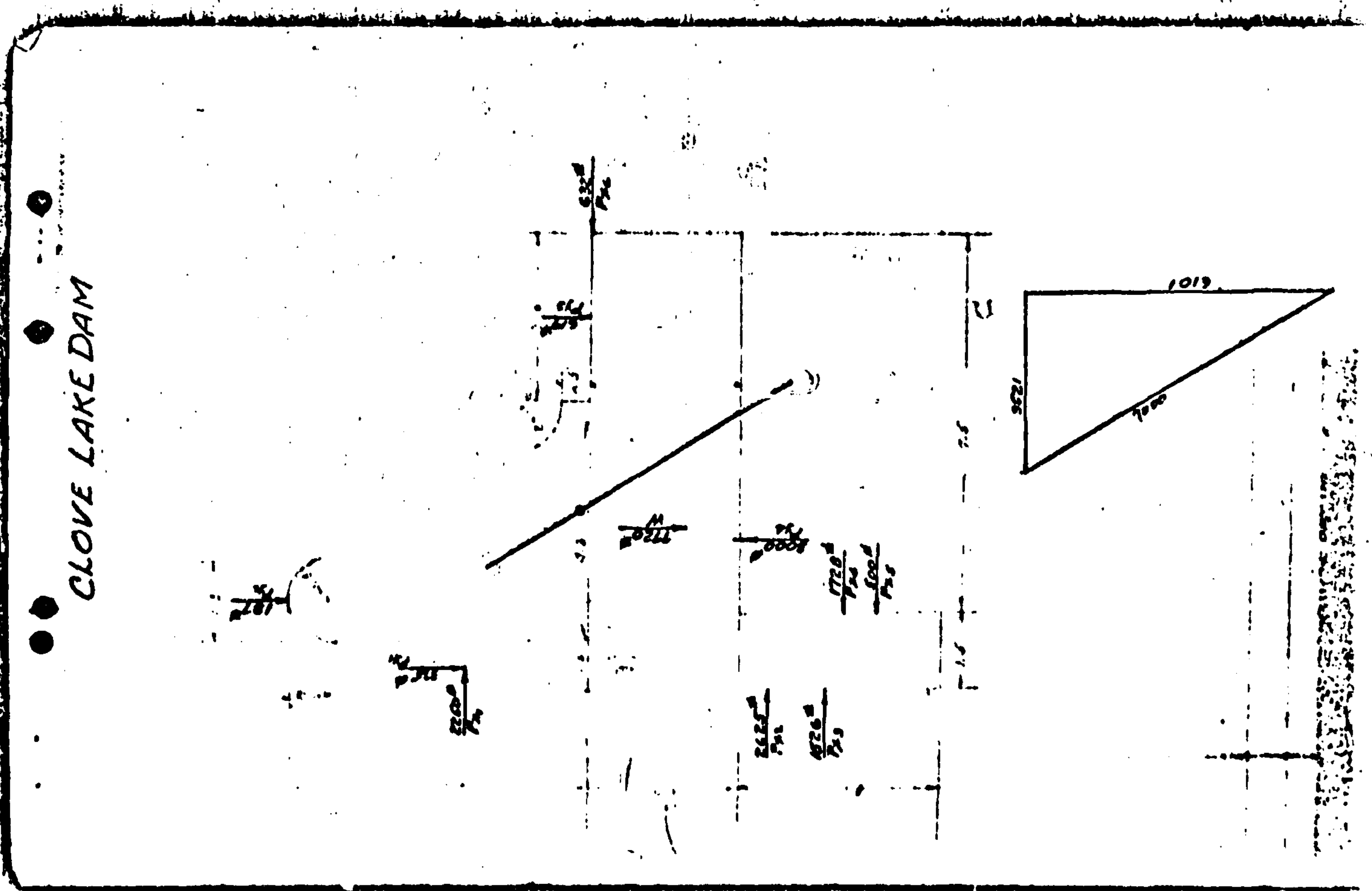
Clove Lake Dam "SEI (Revised)
Stability Analysis
See attached sheet
Scale: ½" = 1'-0"

Clove lake
stability

Stability Analysis

Clove Lake Dam

Clove Lake Dam



$x_1 = 3.32'$ $\quad y_1 = 7.0'$ $\quad w_1 = 2.773^{\#}$

$x_2 = 4.5'$ $\quad y_2 = 5.5'$ $\quad w_2 = 4053^{\#}$

$x_3 = 0.75'$ $\quad y_3 = 2.7'$ $\quad w_3 = 90^{\#}$

$w = 7120^{\#}$

$$\bar{x} = \frac{2773 \times 3.32 + 4053 \times 4.5 + 90 \times 0.75}{7120}$$

$$\bar{x} = \frac{25,794}{7120} = 2.25'$$

$$\bar{y} = \frac{2773 \times 7 + 4053 \times 5.5 + 90 \times 2}{7120}$$

$$\bar{y} = \frac{50,905}{7120} = 6.41'$$

$F_{x_1} = \frac{1}{2} w h_1 (h_1 + h_2)$

$= 31.25 \times 6 \times 12$

$P_{x_1} = 2250^{\#}$

$\bar{y} = \frac{1}{3} h_1 \left(\frac{3h_2 + h_1}{2h_2 + h_1}\right) = \frac{1}{3}(6)\left(\frac{6+6}{6+12}\right) = 2 \times \frac{12}{18}$

$\bar{y} = 2.5'$ point of application

$P_{x_2} = w h_1 h = 62.5 \times 6 \times 7$

$P_{x_2} = 2625^{\#}$

$\bar{y} = \frac{1}{2} h = \frac{1}{2} 7$

$\bar{y} = 3.5'$ point of application

$P_{x_3} = \frac{62.5 \times 7}{2} \times 7 = 1531^{\#}$

$\bar{y} = \frac{1}{3} h = \frac{1}{3} 7 = 2.33'$ point of application

$P_{x_4} = (62.5 \times 7) \times 4 = 1749^{\#}$

$\bar{y} = 3.5'$ point of application

Clove Lake Dam

$P_{x_2} = \frac{(62.5 \times 4.5)}{2} 4.5 = 632^{\#}$

P = 1' point of application

$P_{x_3} = \frac{(62.5 \times d)}{2} \times d = 500^{\#}$

P = 1/3 d = 1.33' point of application

$P_{y_1} = P_{x_1} \tan \phi$

$P_{y_1} = 2250 \times .16666$

$P_{y_1} = 375^{\#}$

P = 2.5' point of application

$P_{y_2} = whA = 62.5 \times 3 \times 1$

$P_{y_2} = 187^{\#}$

P = 1.65' point of application

$P_{y_3} = whA = 62.5 \times 3 \times 2.3$

$P_{y_3} = 619^{\#}$

P = 7.35' point of application

$P_{y_4} = \frac{\gamma_w b}{2}(h_1 + h_2')$

$= \frac{1 \times 62.5 \times 8}{2}(9+3)$

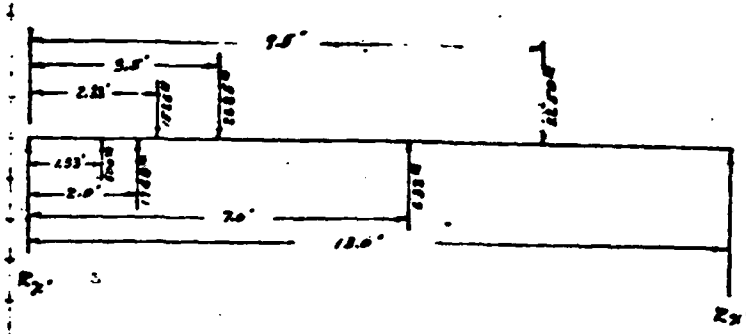
$P_{y_4} = 3000^{\#}$

$P = 1/3\, b\left(\frac{h_1+2h_2'}{h_1+h_2'}\right)$

$P = 8/3\left(\frac{9+6}{9+3}\right) = 3 \times \frac{5}{4}$

P = 3.75 point of application

Clewlake Dam



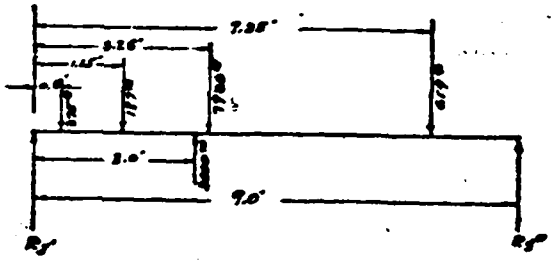
$M_{R_x} = -500 \times 1.33 - 1748 \times 2.0 + 1526 \times 2.33 + 2225 \times 5.5 - 632 \times 7.0 + 2250 \times 9.5$

$= -665 - 3496 + 3556 + 9187 - 4424 + 21,375$

$M_{R_x}' = 25,533$

$R_x = +1526 + 2225 + 2250 - 500 - 1748 - 632 = 3521^{\#}$

$p = \frac{25,533}{3521} = 7.26'$



$M_{R_y} = +875 \times 0.5 + 187 \times 1.25 + 7720 \times 5.25 - 3000 \times 3.0 + 619 \times 7.25$

$= +438 + 234 + 40,530 - 9000 + 4488$

$M_{R_y}' = 21,787$

$R_y = +875 + 187 + 7720 + 619 - 3000 = 6101^{\#}$

$p = \frac{21,787}{6101} = 3.57$

Clare Lake

Clove Lake

MEMORANDUM

DATE March 4, 1964

TO: Robert L. Hardman

FROM: Raymond A. Webster

SUBJECT: CLOVE LAKE DAM, APPLICATION NO. 551

A permit to construct subject dam was issued April 9, 1962 to the Clove Lake Enterprises. Construction was started about that date but changes were made requiring its completion to be delayed. An extension of time for completion was granted March 25, 1963 to October 1, 1963.

I understand that as of this date the dam is about 90% completed, being constructed according to plans filed February 24, 1964 by Lee Hardin, of Snook & Hardin, Consulting Engineer.

Said plans submitted in the name of Holiday Lake, Inc., show revisions as follows:

1. Earthfill section enlarged to accommodate a 30 foot roadway on dam crest;
2. Dam and spillway raised 6.60 feet and 6.50 feet respectively;
3. Spillway lengthened 20 feet; Bridge to span spillway
4. Ogee spillway section slightly enlarged;
5. Other "automatic" changes such as larger and deeper lake and longer blow-off pipe lines.

A check of the hydraulics and stability of the spillway indicates same to be quite satisfactory.

Specifications approved with subject application remain unchanged.

Since the above changes of plans consist of satisfactory revisions to the basic approved plans and construction is proceeding on the No. 551 permit, I recommend that said revisions be approved to amend said permit.

On the other hand, the revised plans were filed by a new owner, Holiday Lakes, Inc., who must be required to accept the April 2, 1962 construction permit and conditions thereto and, of course, the permit covering revised plans. This action would retain present file.

Raymond A. Webster

RAW:AO

Clove lake

Form 50—125—10-60

RECEIVED

OCT 2 1963

DEPT. OF CONSERVATION & ECON. DEV.
DIVISION OF WATER POLICY AND SUPPLY

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
DIVISION OF WATER POLICY AND SUPPLY
20 WEST STATE STREET
TRENTON, NEW JERSEY

DAM APPLICATION No. 651

APPLICATION FOR PERMIT FOR CONSTRUCTION OR REPAIR OF DAM

Montague Township, Sussex Co New Jersey

October 3, 1963

To the Division of Water Policy and Supply,

Gentlemen:—

In compliance with the provisions of Title 58, Chapter 4, Revised Statutes HOLIDAY LAKE, INC., Route 17, Ramsey, New Jersey(Formerly Clove Lake Enterprises,) (Here insert name and address of public authority, private person or corporation which will be the owner of the dam) hereby makes application for the approval of drawings and for the issuance of a permit to construct (reconstruct, repair) a dam known as Clove Dam (Here insert name of dam) across Shimers Brook (Here insert name of stream) in Sussex County, New Jersey, at a point 1/4 mile up stream from County Bridge # 289 (Here give location by distance from mouth of stream, a road or municipal boundary or other political feature) for the purpose of Development (Here state the purpose of the proposed dam)

in accordance with the following information and with the complete specifications and drawings filed with this application and made part hereof, as follows:

Area of water shed 5 square miles.

Maximum depth of lake 16 feet feet.

Area of water surface 100, more or less acres.

Capacity of spillway at 2.5 feet head, is 1200 cubic feet per second.

The character of the foundation material is Hard gravel

As determined by Test Holes shown on plans

Papers attached:—

- ☒ 1. Specifications for structure.
- ☒ 2. Location map.
- ☒ 3. Drawings (blue prints not over 30 inches wide) showing.
  - ☒ a. Plan of structure.
  - ☒ b. Longitudinal section of dam site.
  - ☒ c. Cross sections of dam and spillway.
  - ☒ d. Result of borings or other sub-surface investigations at dam site (if made).

The specifications and drawings have been prepared by Snook & Hardin, W.J. Hardin, Newton, N.J. License No. 40
(Give full name and address of engineer.)

Respectfully submitted,

W.J. Hardin

by _____

NOTE: This application together with drawings, specifications, information and data filed in connection therewith will remain on file in the office of the Division of Water Policy and Supply.

Clove lake

April 11, 1963

John Fitch Key Plaza
Trenton, New Jersey

P. O. Box 1390
Trenton, N. J.

Holiday Lake, Inc.
Route 17
Ramsey, New Jersey

Re: Clove Lake Dam, Application No. 551

Gentlemen:

Examination of the application and drawings filed February 14, 1963 in your name by Mr. W. J. Hardin of Hardin and Hardin, Consulting Engineers, for a permit to construct a dam across Skinners Brook discloses certain revisions to the original drawings filed for this structure on September 20, 1961 by Clove Lake Enterprises, 545 Fifth Avenue, New York, New York.

These revisions to the original drawings include but are not limited to the following features: (a) Earthfill section enlarged to accommodate a 30-foot wide roadway on top of the dam embankment; (b) dam and spillway raised 6.60 feet and 6.50 feet respectively; (c) spillway lengthened 20 feet, with bridge to span same; (d) ogee concrete spillway enlarged slightly.

Attached find copy of permit issued April 2, 1962 to Clove Lake Enterprises for construction of this dam in accordance with plans filed therefor September 22, 1961.

Upon receipt of written acceptance of the terms and conditions imposed in this previous permit upon the enclosed form, the new drawings listed below will be approved as a modification in detail of the design originally approved April 2, 1962. Drawings to be approved as modification in detail are as follows:

1. "Plan of Dam for Clove Lake"
2. "Cross-Sections of Dam for Clove Lake"
3. Untitled drawing showing Section Thru East Wingwall Spillway, Section Thru West Wingwall Spillway, Section of Spillway at East Wingwall

Clove Lake

Holiday Lakes, Inc. April 13, 1959

While the proposed bridge piers do not appear to interfere with proper functioning of the spillway, it will be necessary for you to submit additional drawings showing details of pier construction in plan and section, and a section through the spillway showing piers and deck, for further approval before the bridge is built.

Very truly yours,

George E. Shanklin
Chief Engineer and
Acting Director

GES:jo

Encl.

cc: W. J. Hardin

DAM APPLICATION NO. 553

RECEIVED

MAY 7 '62

DIVISION OF WATER POLICY AND SUPPLY

STATE OF NEW JERSEY

DIVISION OF WATER POLICY AND SUPPLY

ACCEPTANCE OF PERMIT FOR CONSTRUCTION OR REPAIR OF DAM

Division of Water Policy and Supply
32 East Hanover Street
Trenton 8, New Jersey

Gentlemen:

We hereby acknowledge receipt of your permit issued ..... April 30th, 1962 ..... in response to our application for permit for the construction (or repair) of A Dam ..... across GRIER'S BROOK ..... Name of Stream at (near) Montague Township, Sussex County, New Jersey .....

We hereby accept and agree to abide by and fulfill the terms and conditions therein imposed in carrying out the construction work therein authorized.

By Alexander Meerbaum
Name of Applicant

.....

.....

May 3rd 1962

March 21, 1962

32 E. Hanover St.
Trenton, N. J.

Mr. Alexander Dreiband
Dreiband, Bleecker & Silbermann
515 Fifth Avenue
New York 17, New York

Dear Mr. Dreiband:

This is in response to your letter of March 12, 1962 regarding the approval of plans and specifications for your dam.

We are awaiting final revision of plans for the spillway control section as discussed with Mr. Lee Hardin during conference in this office on March 15, 1962. Upon receipt of the revision, we will be in a position to inform you, by letter, whether the plans and specifications are acceptable in their entirety. If they are, letter will be your authority to proceed with construction of the dam pending issuance of the formal permit.

Very truly yours,

Robert L. Hardman, P. E.
Chief, Bureau of Water Control

JCR:ss

8/17/41

Harlin, August 8-1930

Montague [illegible]

Close [illegible] [illegible] Area 5.25 sq mi.

H = 3.0
L = 80'

[illegible] 80 1792 cfs C = 3.3 H 3.0 2.0 3.0 L 103 100 57

Harlin 1000 cfs H = 3' L = 72'

[illegible] Creek - [illegible] to [illegible] [illegible].

Mag. - North [illegible]

5
400
5½
2000 cfs

[illegible]
100
5½
40
80
840

180
5¼
450
180
1140

10-foot [illegible]

1896 + 1957 Bridge

6 × 23

C = 3.55 OK
H = 3.0
L = 80' 1470
100' 1792

Called back Thursday.

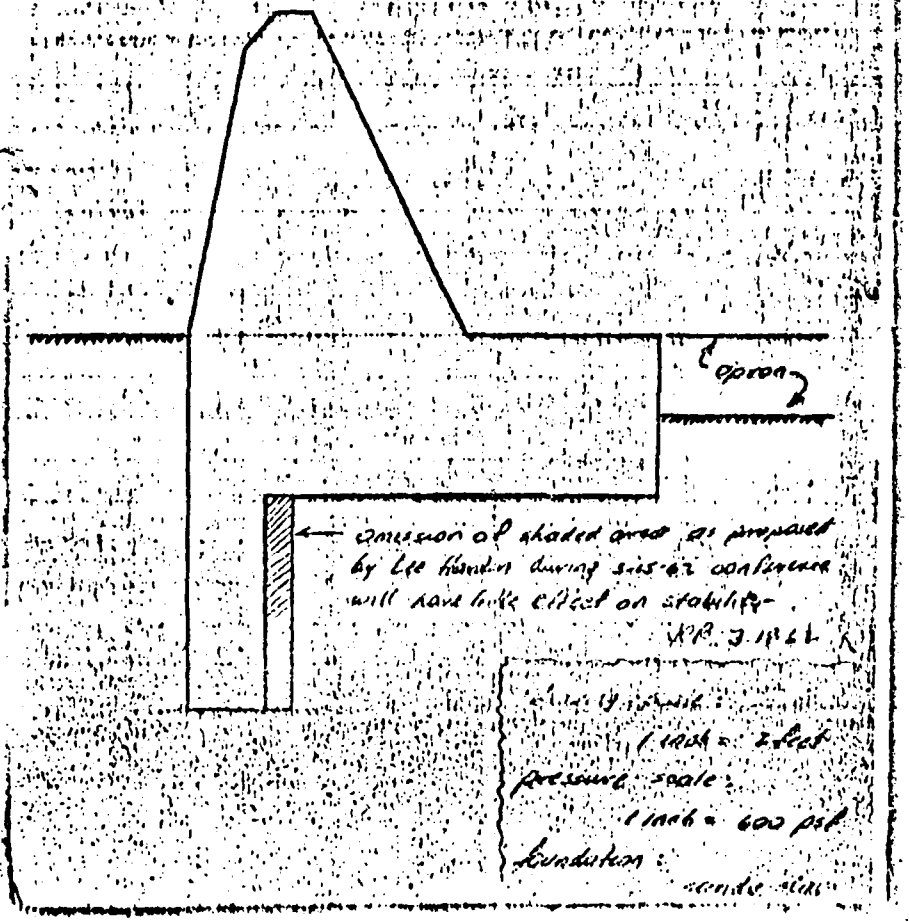
Use H = 2½
C = 3.55
L 80' 100'

Clear Lake Dam
Appl. No. 551

Hydrologic Investigation

Clove Lake Dam

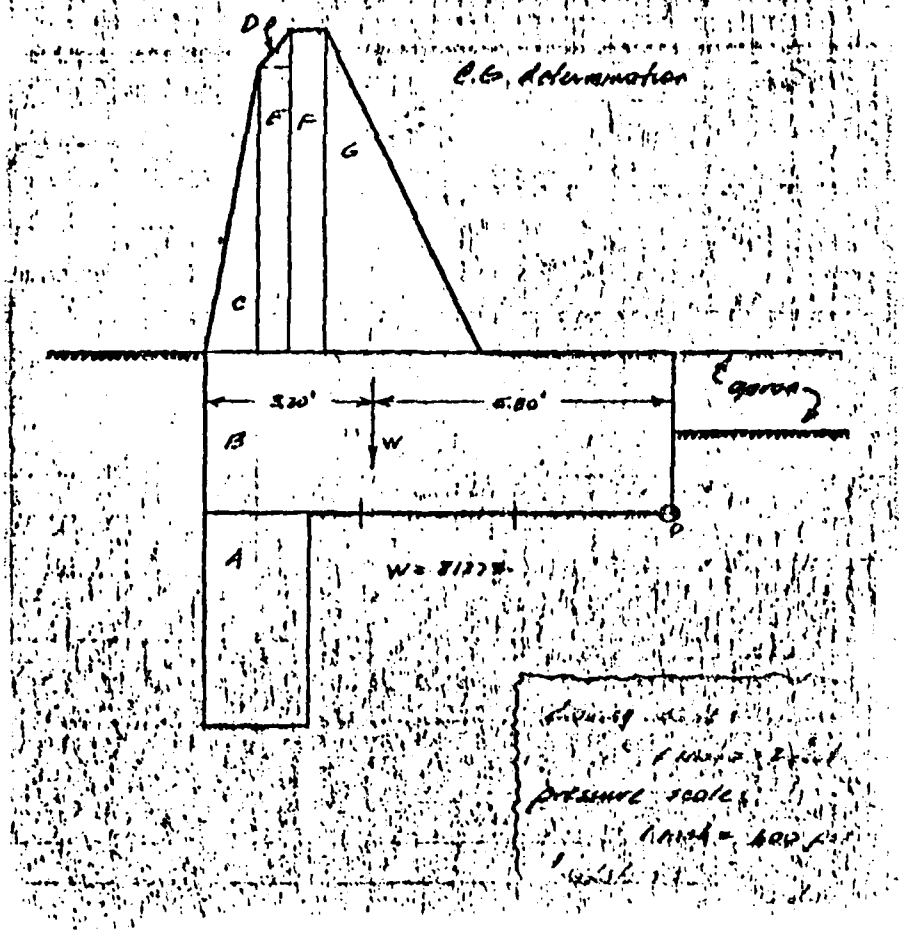
Clove Lake Dam - Recommended Section



Clove Lake Dam

Clove Lake Dam: Recommended Section

C.G. determination



Clove late Dam

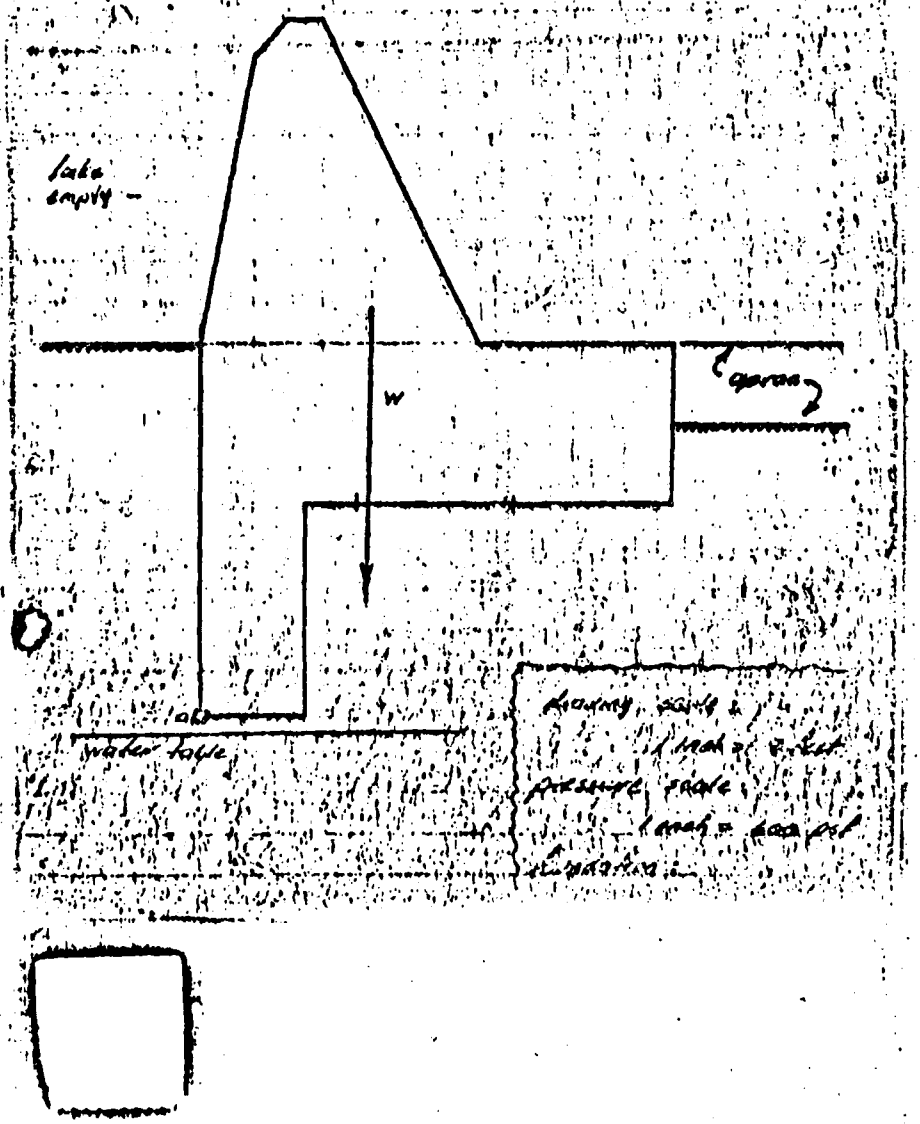
Clove Lake Dam - Appl. No. 551

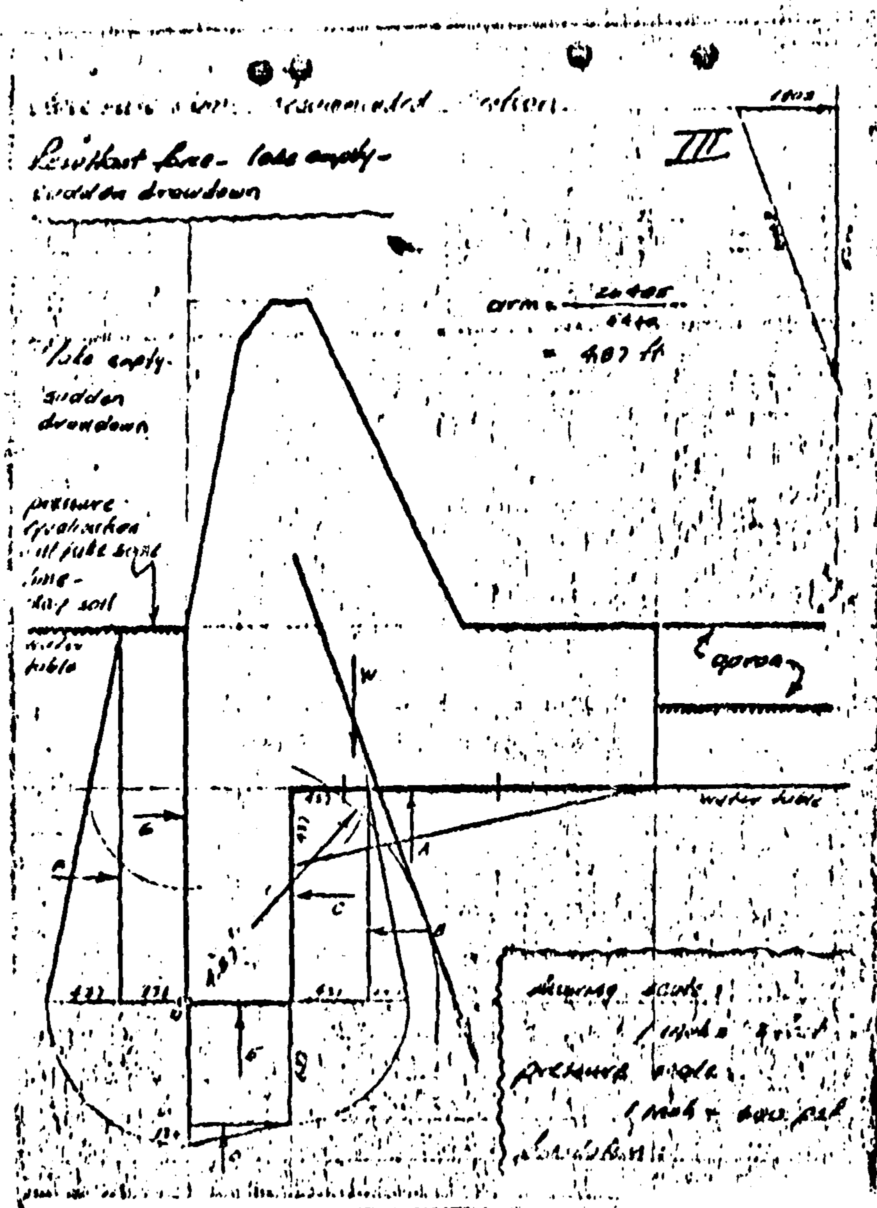
AREA	height	width	area multiplier	area	arm about point O	moment about point O	resultant moment arm	unit wt. of concrete	gross wt. of section
A	4.00	2.00	1.00	8.00	8.00	64.00			
B	3.00	9.00	1.00	27.00	4.50	121.50			
C	5.25	1.00	0.50	2.63	8.33	21.91			
D	0.75	0.65	0.50	0.24	7.56	1.81			
E	5.25	0.65	1.00	3.41	7.67	26.15			
F	6.00	0.65	1.00	3.90	7.02	27.38			
G	6.00	3.00	0.50	9.00	5.70	51.30			
				54.18		314.05	5.80	150	8127

Clove lake !

Clove Lake Dam - Reservoir Broken

Rainfall Source - lake empty





Resultant force - lake empty - sudden drawdown
III
lake empty - sudden drawdown
pressure ... line - dry soil
water table
apron
W
A
B
C
water table
drawing scale
pressure scale

Clover Lake Dam - Appl. No. 551

FORCE	min. press.	max. press.	ovg. press	area	force	moment arm	pos. moment	neg. moment	net moment
A	0	437	219	7.00	1533	4.33		6638	
B	0	250	125	4.00	500	1.33		665	
C			437	4.00	1748	2.00		3496	
D	0	124	62	2.00	124	0.67		83	
E			687	2.00	1374	1.00		1374	
F	0	437	219	7.00	1533	2.33	3571		
G			374	7.00	2618	3.50	9163		
W					8127	3.20	26006		
							38741	12256	26485

* about point a

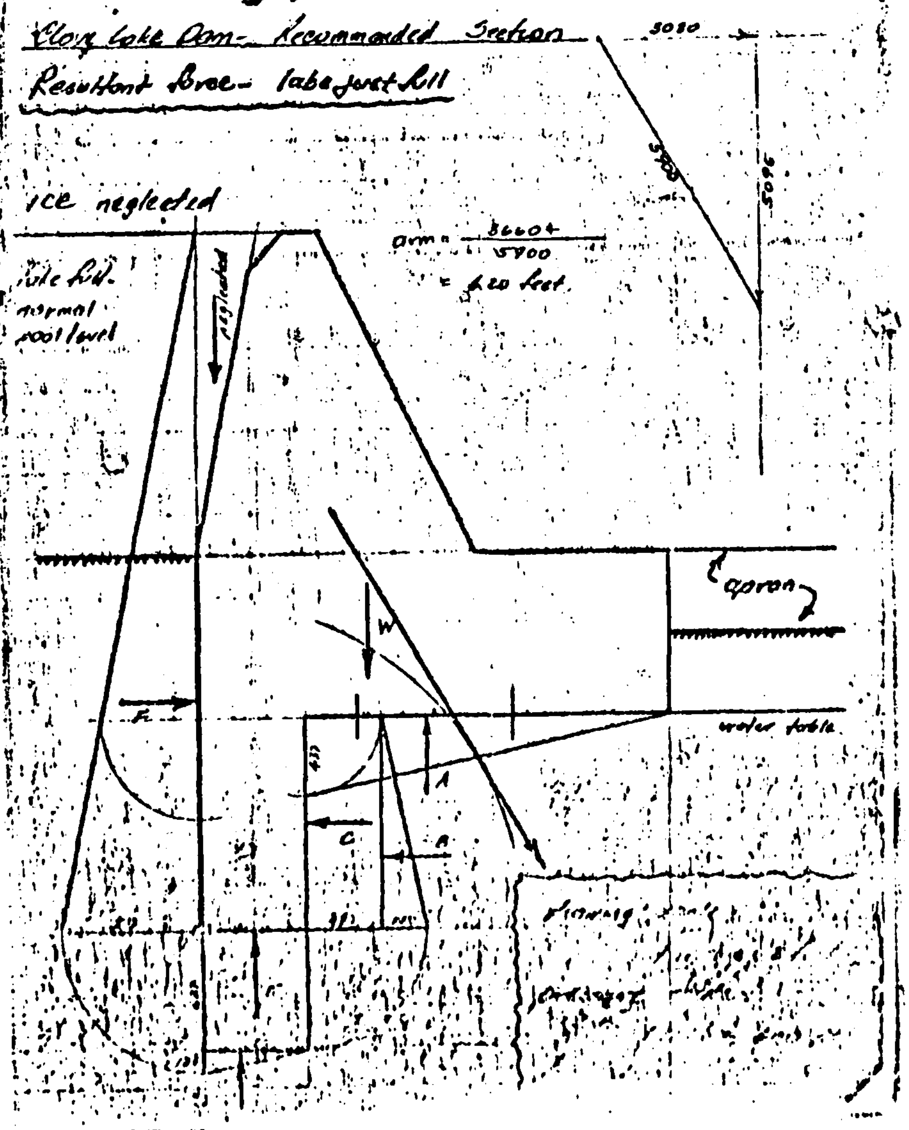
Clove Lake Dam - Appl. No. 551

Force	+ →	− ←	+ ↓	↑ −	ncl →	ncl ↓								
A				1533										
B		500												
C		1748												
D				124										
E				1874										
F	1533													
G	2618													
W			8177											
	4151	2248	8177	3031	1803	6596								

IV

Elory Lake Dam - Recommended Section

Resultant Force - Lake just full

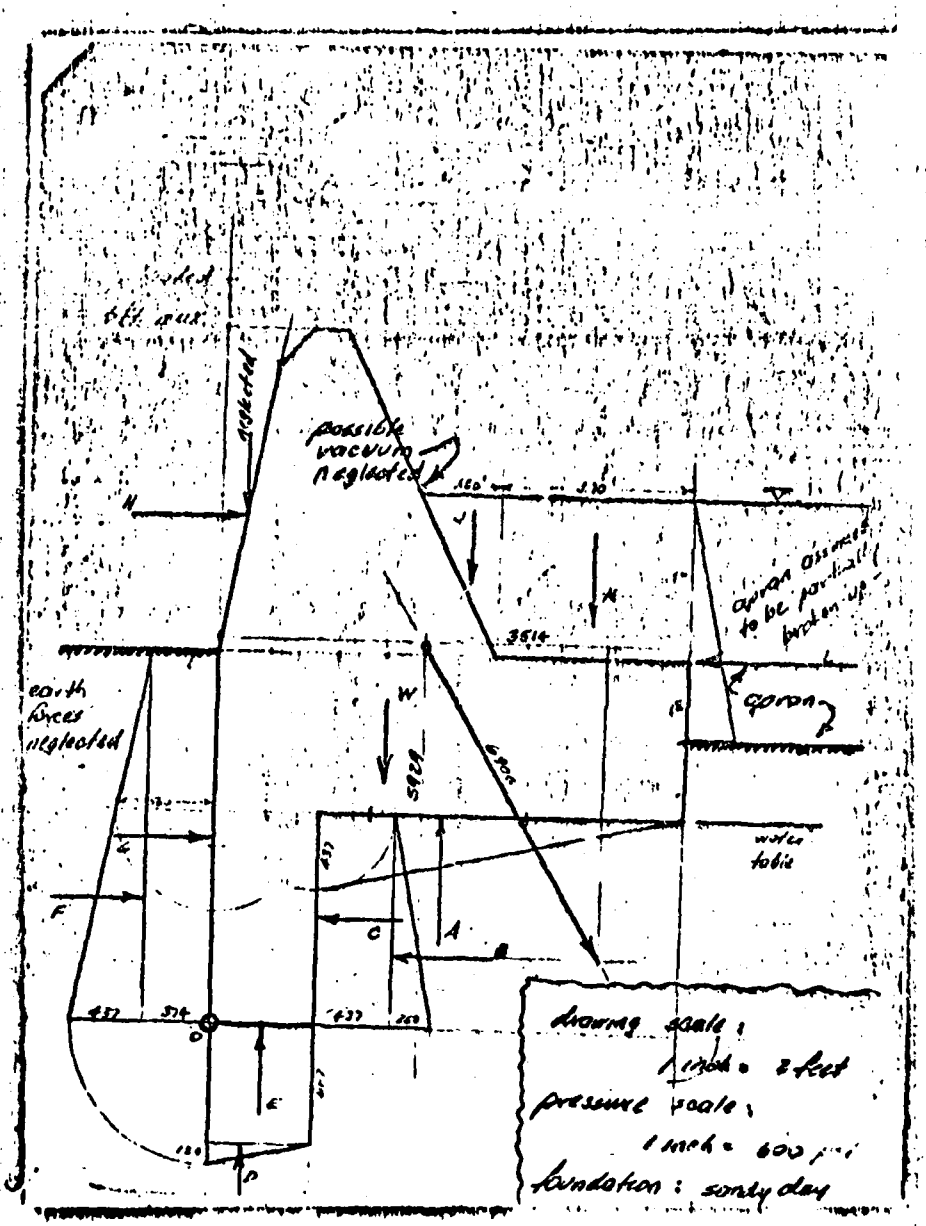


Clove Lake Dam - Bri. No 551

Face	min. press.	max. press.	Orig. press	Area	Load	moment arm ft	gen. moment	neg. moment	net moment					
A	0	437	219	200	16333	4.33		6038						
B	0	250	125	400	300	1.33		665						
C			437	400	1748	2.00		3496						
D	0	124	62	2.00	124	0.67		83						
E			687	2.00	1374	1.00		1374						
F	0	811	406	13.00	5278	4.33	22854							
W					5127	3.20	16006							
							45860	12256	33604					
			+ 700 # point O											

Clove Lake Dam - Apt. No. 551

Circ.	+ →	− ←	+ ↓	− ↑	net →	net ↓								
A				1533										
B		500												
C		1748												
D				124										
E				1371										
F	5278													
W			8113											
	5278	2248	8113	3031	3030	5082								


possible vacuum neglected
earth forces neglected
water table
drawing scale:
1 inch = 2 feet
pressure scale:
1 inch = 600 psf
foundation: sandy clay

Clove Lake Com. Appl. No. 551

Force	min. press.	max. press.	avg. press.	area	force	moment arm	+ moment horiz. force	+ moment vert. force	neg. moment horiz. force	neg. moment vert. force	net + moment horiz. forces	net + moment vert. forces	Σ of moment	
A					1533	4.33				6638				
B					500	1.33			665					
C					1738	2.00			3470					
D	see previous	reviews			124	0.67				83				
E					1374	1.00				1374				
F					1533	2.33	3572							
G					2618	3.50	9163							
H	see attached sheet				2246	9.50	21337							
W					8127	3.20		26000						
J	0	187	94	1.50	141	4.80		677						
K			187	3.70	692	7.15		4948						
L	0	281	141	4.50	635	7.00			4445					
							34072	31621	8606	3095	25466	23536	49002	

+ about point O

Floyd Lake Dam - Hyd. Mo. 551

determine "H" using equation based on Fig. 51, page 900 of Civil Engineering Handbook -

$$H = \frac{1}{2} w h (h + 2h_1) \# \quad \begin{cases} h = 6 \text{ ft.} \\ h_1 = 3 \text{ ft.} \end{cases}$$

$$= \frac{1}{2} \times 62.4 \times 6 (6 + 2 \times 3) \#$$

$$= 187.2 (12) \#$$

$$= 2246 \#$$

determine moment arm based on figure 51

$$\text{arm} = 7.00^* + \frac{1}{3} h \left(\frac{h + 3h_1}{h + 2h_1} \right)$$

$$= 7.00 + \frac{6}{3} \left(\frac{6 + 3 \times 3}{6 + 2 \times 3} \right)$$

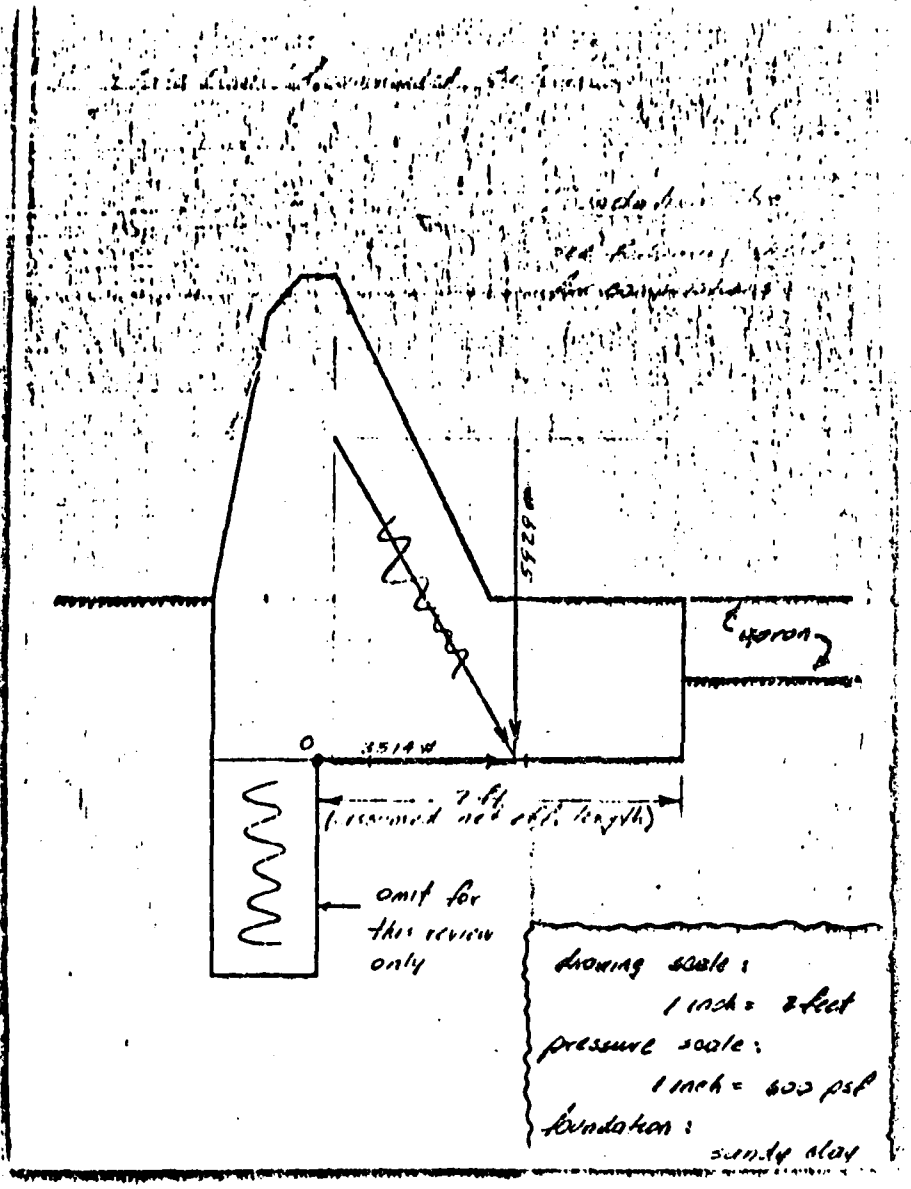
$$= 7.00 + 2 \left(\frac{15}{12} \right)$$

$$= 9.50 \text{ feet}$$

*arm must be corrected to point below grade

Clove Lake Dam Spl. No. 551

Force	positive → forces	neg. ← forces	positive ↓ forces	negative ↑ forces	net → forces	net ↓ forces	net moment → forces	moment arm → forces	net moment ↓ forces	moment arm ↓ forces
A				1533						
B		500								
C		1748								
D				124						
E				1374						
F	1583									
G	2618									
H	2246									
I			8127							
J			141							
K			612							
L		635								
	6377	2883	8760	3031	3514	9524	15866	225	22536	3.97


5529 #
0
3514 #
omit for
this review
only
drawing scale:
1 inch = 2 feet
pressure scale:
1 inch = 600 psf
foundation:
sandy clay

[illegible] Proposed (Map No. 11-26) | Hydrologic Record

April 551

Stream	dist.	direct.	type [illegible]	Map No.	Appl. No.	drainage area	year appr.	design flood recurr. interval	design csm	Spillway curve	50-yr corr. factor	50-yr. curve
	miles					sq. mi.		years				
[illegible] Brook	0.41	u.s.	dam	22-164	498	1.00	1956	?	400	C		— C
[illegible] Brook	5.11	ENE	dam	22-142	142	3.40	1924	?	151	0.70 C		—
[illegible] Brook	0.31	D.S.	[illegible]	11-16	501	5.1 (?)	1936	[illegible]	110	0.71 C	1.20	0.71 C
Little [illegible] Brook	2.31	SSW	[illegible]	21-52	1434	2.01	[illegible]	?	278	C		—
Little [illegible] Brook	1.41	S	[illegible]	11-57	1582	1.11	[illegible]	?	384	C		—
[illegible] Brook	1.01	D.S.	[illegible]	21-81	2043	6.34 (?)	[illegible]	15		C	1.20	1.0 C
[illegible] Brook	4.61	SE	[illegible]	22-122	1149	d.s.	1930	15		[illegible]	1.00	[illegible]

Revelstoke Dam – proposed

Map A.C. 11-36 Apr. '51

Gauge stands

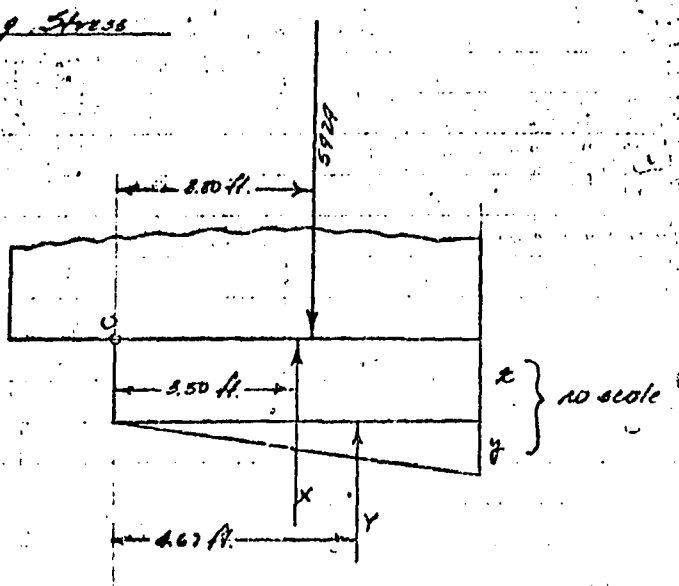
Gauge	Drainage area		50 yr. Q		50 yr. csm		NJ csm	1.40 × NJ csm	CJ csm	1.20 × CJ csm	mean csm	1.20 × mean csm
Flat Creek	65.1		4150		65		151	181	49	59	100	120

Grove Lake Dam · Proposed (Map No. 11-56) Tabular Hydrology

Sq. 551

Route	max. elev.	min. elev.	Δ elev.		dist.	dist.	Cal. "T"	cal. "T"	m All. hour		Tc	
					feet	miles	min.	hours	hours		hours	
A *	1260	510	750		27600	5.23	—	1.38	0.20		1.58	
B *	1400		890		27000	5.11	—	1.31			1.51	
C *	1310		800		24700	4.68	—	1.23			1.43	
D *	780	↓	270		14800	2.82	—	0.97	↓		1.17	
						max.		1.38	0.20		1.58	
						min.		0.97	0.20		1.17	
						mean		1.22	0.20		[illegible]	use
* unaffected by changes in												
drainage area described						total		1.37	1.80			
by [illegible] in letter												
dated 2-8-[illegible]						adj.		1.22	0.20		1.42	
Tc hours	1.38											
Lag hours	2.17											
A acres	3304	(5.24 square miles, based on [illegible] letter)										
[illegible] A	1110											
C	0.25											
Qp cfs	1778											
N(5yr) cfs	275	Q	6010									
CS(") "	174	Q	412		use 120% of the mean of							
mean(") "	285	Q	1493		North & Central areas							
1.20 N(50yr) "	474	Q	2484									
" CS " "	209	Q	1075									
mean (") "	342	Q	1792	←								

Bearing Stress



sum of moments about point O = zero

$$5929 \times 3.80 = X \times 3.50 + Y \times 4.66$$

sum of vertical forces = zero

$$5929 = X + Y$$

$$\therefore \quad 5929 \times 3.80 = X \times 3.50 + 4.66(5929 - X)$$

$22530 = 3.50X + 2763 - 4.66X$

$1.16X = 5099\ \#$

$X = 4396\ \# \quad = 7\%$

Therefore $X = 628\ psf$

since $Y = 6929 - X$

$= 6929 - 4396$

$Y = 1533 \quad = \frac{7y}{2}$

Therefore $y = \frac{2}{7} \times 1533$

$= 438\ psf$

max bearing press. $= X + y$

$= (628 + 438)\ psf = 1066\ psf$

Allowable bearing stress varies from 1 to 2 tsf per square foot - see pg 711 of Civil Engr. Handbook

Bearing Stress

$b = \frac{3514}{7}$ psf

$= 502$ psf min. allowable is 1200 psf – see page 892 of Civil Engineering Handbook –

VI Continued

Flow Gate Gen. Recommended Section

Soil pressures

$\Sigma M = 0$ ⓐ $6800 \times 2.70 = \frac{y}{2} \times y \times \frac{y}{3}$

avg. pressure (a) $\frac{y}{2} = 6500$

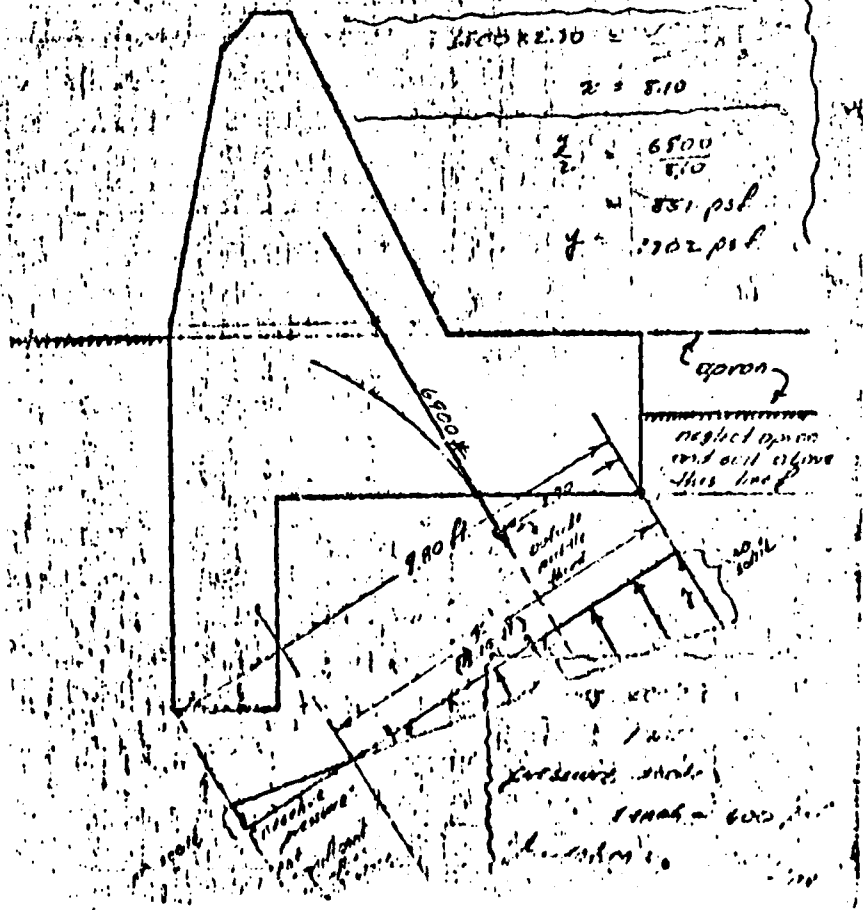
$6500 \times 2.10 = x$

$x = 8.10$

$\frac{y}{2} = \frac{6500}{8.10}$

$= 851$ psf

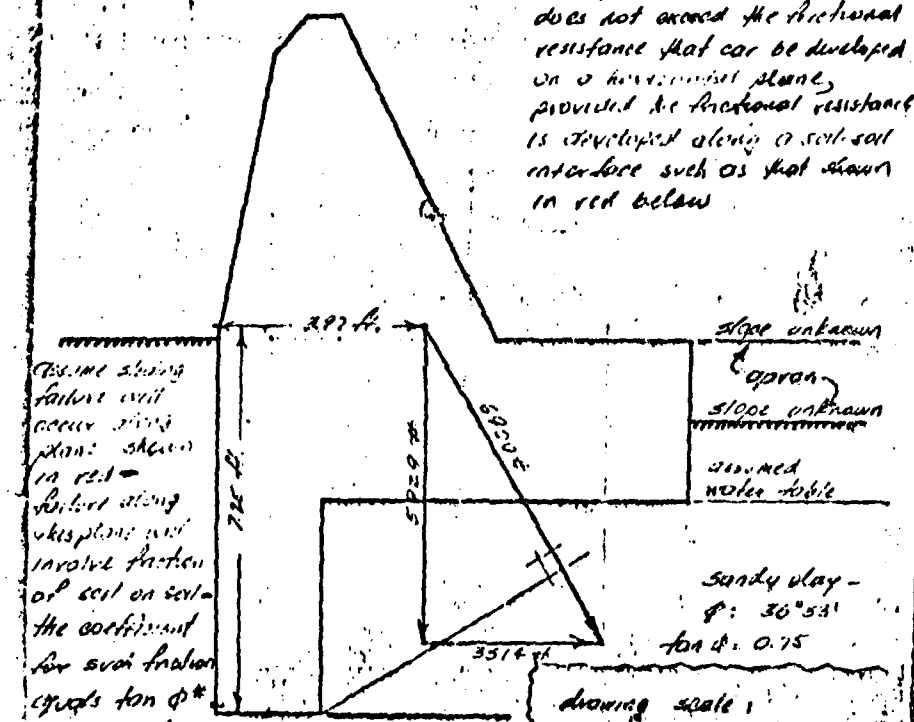
$y = 1702$ psf



Sluice Gate Gate - Recommended Factors

Resistance to sliding.

OK because horizontal thrust does not exceed the frictional resistance that can be developed on a horizontal plane, provided the frictional resistance is developed along a soil-soil interface such as that shown in red below



Assume sliding failure will occur along plane shown in red - failure along this plane will involve friction of soil on soil - the coefficient for soil friction equals tan φ* neglecting the weight of soil in area shaded green, the resisting force developed along the plane of sliding is 0.75 x 35'4 = 44'11 which is greater than the horizontal thrust

Ref: Handbook, page 372.

drawing scale:
1 inch = 2 feet
pressure scale:
1 inch = 400 psf
foundation: sandy clay

December 20, 1961

32 E. Hanover St.
Trenton, N. J.

Mr. Lee Hardin
Snook & Hardin
35 Spring Street
Newton, New Jersey

Re: Clove Lake Dam
Dam Appl. No. 552

Dear Mr. Hardin:

Those present at ---
GES
SCR
L. Hardin
MR
1-16-62

In accordance with the understanding reached during the November 17, 1961 conference in this office, we have made a stability analysis of the proposed spillway for Clove Lake Dam as shown on drawings submitted at the time of the conference. Analysis indicates that the assumed critical section, between Sta. 2+10 and Sta. 2+96, is unstable in that the resultant of hydrostatic and active earth pressure forces and the weight of the section strikes the plane of the foundation downstream of its toe rather than within the middle third of its base. Forces due to ice pressure and a probable partial vacuum on the downstream face due to nappe separation, both neglected in the analysis, will increase the degree of instability. Analysis also neglected the resistance provided by the rrouted apron since it is indeterminate, and because of the possibility of apron failure. Because of this apparent instability, the proposed section cannot be approved. Please submit plans for a redesigned section supported by your own stability analysis, since the pressure of other work will preclude another original analysis by our staff for some time. Although the foregoing applies specifically to the section apparently most critical, it is possible that other sections of the spillway may also be unstable and should be investigated.

As pointed out in our letter of November 9, 1961 the analysis of a particular section of spillway should not take into account any lateral support that may, in fact, be contributed by adjacent sections. Resistance to sliding must be provided by

direct horizontal bearing against soil so confined that displacement is unlikely, neglecting frictional resistance by the foundation materials. Assuming the soil directly beneath the spillway to be confined, the necessary resisting force can be developed by a cutoff wall located at the heel of the spillway. The wall must be designed as a cantilever, forming an integral part of the spillway. Even though overlain by the masonry apron, the soil adjacent to the vertical downstream face of the spillway must be considered to be unconfined and to have no bearing capacity, although it may be considered, through slippage along the slope of repose, as part of the upstream pressure component. The Division recommends that the resultant soil pressure due to the cutoff and to the dead weight of the spillway not exceed 1,000 pounds per square foot. No reduction in uplift pressure due to provision of a cutoff wall can be considered unless it can be constructed to provide a positive water cutoff.

Complete review of the said drawings and of the specifications filed on November 30, 1961 will be made as promptly as the current workload permits.

Very truly yours,

Robert L. Hardman, P. E.
Chief, Bureau of Water Control

JCR:ca

JCR

W. A. HARDIN — OFFICE TELEPHONE DUPONT 3-1730 — LEE HARDIN

Snook & Hardin

ENGINEERS AND LAND SURVEYORS

86 SPRING STREET

NEWTON, N. J. November 29, 1961.

Tel. Dupont 3-1730

Re: CLOVE LAKE DAM,
Montague Township,
Sussex County, N.J.

DEPARTMENT OF CONSERVATION,
Division of Water Policy and Supply,
28 West State Street,
Trenton, New Jersey.

RECEIVED
NOV 30 '61
DEPT. CONS. & ECON. DEV.
DIVISION OF
WATER POLICY AND SUPPLY

Attention of Mr. Reilly.

Dear Sir:

Enclosed please find five copies of:

Specifications for the Construction

of

CLOVE LAKE DAM

Montague Township,
Sussex County, N.J.

Yours very truly,

SNOOK & HARDIN

Lee Hardin

afm

November 5, 1962

This letter resulted in conference with Lee Hardin on 11-13-62

Mr. Lee Hardin
37 Spring Street
Ramsey, New Jersey

Re: Clove Lake Dam (Proposed)
Montgomery Township, Somerset County

Dear Mr. Hardin:

This is to confirm information given you during the October 16, 1962 conference on the proposed Clove Lake Dam, to restate for the record certain comments previously made, and to pass them on to you as enforcement findings regarding the design of that structure.

The following have been established as the design criteria for the proposed offset-type spillway control section:

(1) Design flood 1150 cubic feet per second;
(2) Maximum head on spillway crest 2.50 feet;
(3) Emergency flood 1850 cubic feet per second;
(4) Maximum head on spillway crest 3.00 feet;
(5) Weir coefficient (C) = 3.60, assuming crest shape substantially the same as that shown in drawings submitted to date;
(6) Minimum vertical distance, spillway crest to embankment top: 1.00 feet;
(7) Minimum crest length as determined from above data, using weir equation ($Q = CLH^{3/2}$) and with allowance for end contractions.

A spillway designed in accordance with these criteria will obviate provision of an emergency spillway.

The spillway wall may need to be redesigned to direct discharge away from rather than along the toe of the earthen embankment. In addition, strengthening of the embankment toe near the spillway may be necessary. These precautions will help eliminate progressive erosion of the toe as a threat to the safety of the dam.

The use of grouted stone paving in the upper part of the spillway waterway is considered acceptable, assuming that all stones therein will be carefully selected as to shape and durability, placed with inter-stone clearances that recognize the dual requirements of drainage and grouting, and properly bedded for stability and to minimize chance of settlement, which grouting probably could not prevent. Weep holes having a minimum diameter of three inches and keeping pockets of crushed stone connecting with the inter-stone spaces should be provided on five-foot centers except in the immediate vicinity of the spillway control section.

The specification relating to spillway paving does not state that the stones therein will be grouted in place, and no note to that effect appears on the pertinent drawings. Please revise either the specifications or drawings or, preferably, both to show that the paving stone will, in fact, be so anchored.

The proposed control section may be unstable, particularly in the vicinity of Sta. 7+80. Hence, redesign, perhaps to include a horizontal leg that could form part of the apron, may be necessary. Please note that a stability analysis of any given length of spillway should not recognize the support that might in fact be produced by adjoining wing walls or lengths of spillway of differing cross-section.

The Division feels that some sheeting along the crest line of the proposed control section is desirable. Such sheeting would minimize the effect of water working its way under the control section, would have a beneficial effect on its stability, and conceivably could save it should failure of the paving permit undermining to begin. Please inform this Division in writing of your feeling in this matter.

The specification regarding wetting of embankment fill makes no mention of the disposition to be made of material that is oversaturated in place. Common practice is to harrow the material to permit more rapid evaporation of the excess water. If time is of the essence, the alternative is removal of the defective material. Please expand the said specification to cover this consideration.

The specification regarding placing of materials indicates that the various layers of fill shall be sloped toward the embankment core. This procedure will cause any rainfall to concentrate along the core, possibly leading to oversaturation of the fill in its vicinity and interference with proper compaction. Hence, the procedure cannot be recommended.

The Division cannot consider the formation of earth dam fill by trucks or other wheeled vehicles not specifically designed for that purpose to be acceptable. Therefore, arrangements will have to be made

for such work to be done by sheeps-foot roller, which was mentioned in the specifications, or other suitable methods. Where the sheeps-foot roller or suitable alternative method cannot be used, as adjacent to the spillway structure, portable power driven tampers should be used. Please make the necessary revisions in the specifications.

Based on your contention that earthen cores such as is proposed for Clove Lake Dam have been used with success in the past, the Division is willing to approve its use in that structure. Work on the core must, of course, be subject to close engineering supervision. Please revise the pertinent specifications to reflect the change in the core and to include a complete description of the method of construction of the substitute. The revised specifications should also note that cutoff of extensive porous zones in the foundation will, if more economical, be accomplished with sheeting.

The Division cannot recommend the use of transite pipe blow-offs because of the probability that such pipes will be fractured due to uneven settlement of the surrounding material. In such an event the leakage created would eventually cause the failure of the embankment or the dewatering of the pond. However, in this case we will give favorable consideration to your request for the use of the transite pipe, provided the blow-offs are carefully embedded in material free of stone that may fracture them and properly compacted to reduce the settlement and shrinkage to a minimum.

It is noted that no provision for the rip-rapping of the upstream embankment face as a measure of protection against the erosive effect of wave action has been made. Please provide for such surfacing, which should extend from the top of the upstream slope to a level not less than three feet below the spillway crest elevation, and, of course, from one end of the embankment to the other. The rip-rap should be bedded on a gravel filter. A paragraph on rip-rapping should appear in the specifications.

It is noted that neither the specifications nor drawings indicate the type of cover with which the embankment top and downstream slope are to be planted as a measure of protection against erosion. Please add a paragraph on such cover to the specifications. Note that the use of a dense grass having a substantial root system or honeysuckle will be satisfactory to this Division.

The specifications do not state that work on Clove Lake Dam will be supervised by a New Jersey licensed professional engineer or his qualified representative. Please note that permit for the dam will contain a condition requiring such supervision.

Very truly yours,

George R. Shanklin
Chief Engineer and
Acting Director

JCKess
Encl.

RECEIVED
SEP 20 '61
DEPT. CONS. & ECON. DEV.
DIVISION OF
WATER POLICY AND SUPPLY

Form [illegible]

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
DIVISION OF WATER POLICY AND SUPPLY
28 WEST STATE STREET
TRENTON, NEW JERSEY

DAM APPLICATION No. 551

APPLICATION FOR PERMIT FOR CONSTRUCTION OR REPAIR OF DAM

Montague Township, Sussex Co., New Jersey

September 14, 1961

To the Division of Water Policy and Supply,

Gentlemen:—

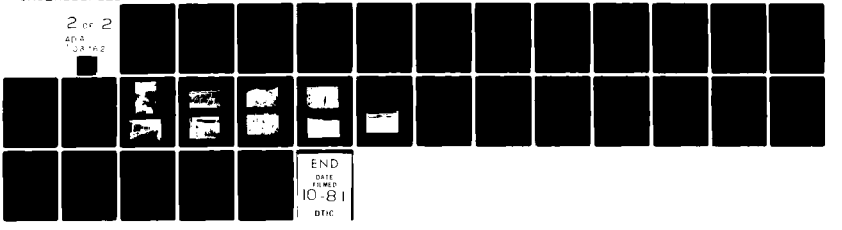
In compliance with the provisions of Title 58, Chapter 4, Revised Statutes Clove Lake Enterprises, 545-5th Avenue, New York 17, N. Y.
(Here insert name and address of public authority, private party or corporation which will be the owner of the dam)
hereby makes application for the approval of drawings and for the issuance of a permit to construct (reconstruct, repair) a dam known as Clove Lake
(Here insert name of dam)
across Shimers Brook in Sussex County, New Jersey,
(Here insert name of stream)
at a point 1/4 mile up stream from County Bridge # 209
(Here give location by distance from mouth of stream, county or municipal boundary or other political [illegible])
for the purpose of summer camps
(Here state the purpose of the proposed lake)
in accordance with the following information and with the complete specifications and drawings filed with this application and made part hereof, as follows:

Area of water shed 5 square miles.
Maximum depth of lake 10 feet.
Area of water surface 63, more or less acres.
Capacity of spillway at 2.5 feet head, is 1,000 cubic feet per second.
The character of the foundation material is Hard Gravel

As determined by Test holes shown on plans

AD-A103 762 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CLOVE LAKE DAM (NJ 00259) DELAWARE--ETC(U)
AUG 81 W A GUINAN DACW61-79-C-0011

UNCLASSIFIED DAEN/NAP-53842/NJ00259-81/ NL



APPENDIX 2

CHECK LIST

VISUAL INSPECTION

CLOVE LAKE DAM

Check List
Visual Inspection
Phase 1

Name Dam Clove Lake Dam County Sussex State NJ (00259) Coordinators NJDEP

Date(s) Inspection 2/18/81, 4/22/81 Weather Sunny, Sunny Temperature 70°, 65°

Pool Elevation at Time of Inspection 615' NGVD Tailwater at Time of Inspection 607.7' NGVD

Inspection Personnel:

W. Guinan
S. Gilman
R. Murdock
K. Stuart
D. Deane
Owner not available

R. Murdock/S. Gilman Recorder

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	- Ogee spillway w/partial height stoplog sections (3 ea) near right abutment. Fish ladder at right end. - Concrete in fish ladder badly eroded and deteriorated, with exposed reinforcing steel. - Concrete on d/s face of entire spillway eroded to expose coarse aggregate. - Concrete surface at each stoplog show deterioration around slots. - Left end of left stoplog section is badly eroded. - A section of the main spillway crest near left center is eroded to a depth 3-in by 3 ft long. - Erosion at each vertical construction joint to a depth of 1-inch. - Concrete apron is surface eroded - One section approx. 3 ft x 3 ft. Left stoplog is cracked and settled approx. 1/2-in. - Abutments at each end - good condition. - No indication of horizontal or vertical movement of major structural elements observed. - Stoplogs are badly weathered. Reinforcing steel uprights are rusted - some bent. - Right stoplogs are sand bagged on u/s face.	Repair deteriorated concrete Repair stoplogs
APPROACH CHANNEL	- Clear and unobstructed	
DISCHARGE CHANNEL	- Brush, debris, boulders; banks eroded and sloughing, no trees.	
BRIDGE AND PIERS OVER SPILLWAY	- Wood deck - surface is worn from traffic. Underside - good condition. - Steel stringers - good condition - minor rusting. - Steel girders - good condition - minor rusting. - Steel column - u/s columns are rusting at waterline - paint is peeling. d/s columns - minor corrosion. - Wood railing - good condition but have little lateral stability.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion on downstream slope, trees, brush and boulders. Erosion on upstream slope due to pedestrian traffic and wave action.	Repair eroded areas.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good	
RIPRAP FAILURES	No riprap visible. Gravel and boulders along water edge result of wave action.	Design and specify erosion protection for the upstream slope of the dam.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RAILINGS	None	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Erosion on both sides of spillway structure.	Repair eroded areas.
ANY NOTICEABLE SEEPAGE	Possible seepage along toe to right of spillway.	Investigate and correct seepage.
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not visible	
INTAKE STRUCTURE	Not visible	
OUTLET PIPE	Two 18-inch low level outlets through right center of embankment. Not visible - concrete in d/s valve chamber in fair condition. Water standing in chamber over top of pipe.	Appears to be an 8-inch siphon pipe on d/s side approx. 6 feet below crest of road.
OUTLET CHANNEL	Clear. Pipes exit through concrete headwall below gatehouse. Tailwater covered outlets at time of inspection.	
EMERGENCY GATE GATE VALVES	Two gates, with wheels, located in concrete house at right center of embankment just above toe of dam on downstream face. According to maintenance supervisor, have been operated recently. Pipes and valves appeared in good condition with some surface rust. Not operated at time of inspection.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Grassed areas, houses, gradual slopes.	
SEDIMENTATION	No evidence of significant sedimentation in reservoir.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Good condition - unobstructed	
SLOPES	Gentle	
APPROXIMATE NO. OF HOMES AND POPULATION	None	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plans available at NJDEP, P.O. Box CN-029, Trenton, N.J. 08625, dated June 1964, by Snook & Hardin Engineers. Plans used as reference for plan and profile included in the report.
REGIONAL VICINITY MAP	Prepared for this report
CONSTRUCTION HISTORY	Records of construction history are available at NJDEP. Copies are included in Appendix 1 of this report.
TYPICAL SECTIONS OF DAM	Available at NJDEP. See "PLAN OF DAM" above.
HYDROLOGIC/HYDRAULIC DATA	Original data on file at NJDEP. See "PLAN OF DAM" above. Copies are included in Appendix 1 of this report.
OUTLETS - PLAN	
- DETAILS	Plans available at NJDEP. See "PLAN OF DAM" above.
- CONSTRAINTS	Not found
- DISCHARGE RATINGS	Not found
RAINFALL/RESERVOIR RECORDS	Not found

ITEM	REMARKS
DESIGN REPORTS	None found
GEOLOGY REPORTS	None found
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Available at NJDEP. See "PLAN OF DAM" on page 2-8. Copies included in Appendix I of this report.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not found
POST-CONSTRUCTION SURVEYS OF DAM	Not found
BORROW SOURCES	Not found

ITEM	REMARKS
MONITORING SYSTEMS	None found
MODIFICATIONS	None found
HIGH POOL RECORDS	None found
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None found
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None found
MAINTENANCE OPERATION RECORDS	None found

ITEMS	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Available at NJDEP. See "PLAN OF DAM" on page 2-8.
OPERATING EQUIPMENT PLANS & DETAILS	Available at NJDEP. See "PLAN OF DAM" on page 2-8.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 5.6 mi2 - woods and wetlands

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 615' NGVD (289 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not applicable

ELEVATION MAXIMUM TEST FLOOD POOL: 615.7' NGVD

ELEVATION TOP DAM: 619.1' NGVD

CREST: Earth embankment, concrete & clay cores, 24' road on top.

a. Elevation 619.1' NGVD

b. Type Earth, concrete and clay cores

c. Width 30 feet

d. Length 400 feet

e. Location Spillover center

f. Number and Type of Gates 3 stoplog bays

OUTLET WORKS: Two 18-inch drawdown pipes

a. Type 18-inch cast iron pipes

b. Location right embankment

c. Entrance Invert 607.5' NGVD (est)

d. Exit Inverts 607.5' NGVD (est)

OUTLET WORKS: One 8 inch siphon

a. Type 8-inch pipe; asbestos cement

b. Location in right embankment right of 18-inch pipes

c. Entrance Invert 613' NGVD (est)

d. Exit Inverts 613' NGVD (est)

MAXIMUM NON-DAMAGING DISCHARGE: 3586 cfs

APPENDIX 3

PHOTOGRAPHS

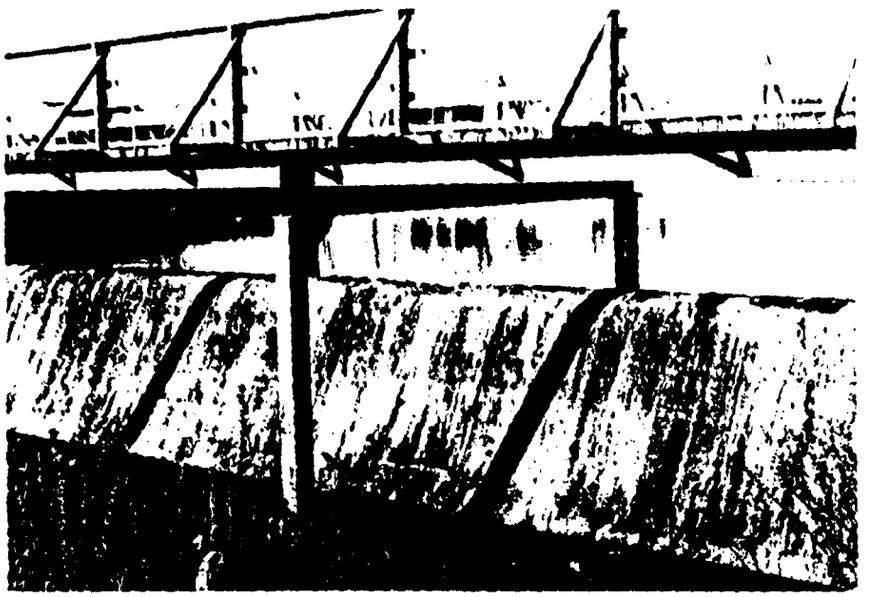
CLOVE LAKE DAM

April 22, 1981

View looking south along axis of ogee spillway with 3 bays of stoplogs on crest. Note erosion in third bay.

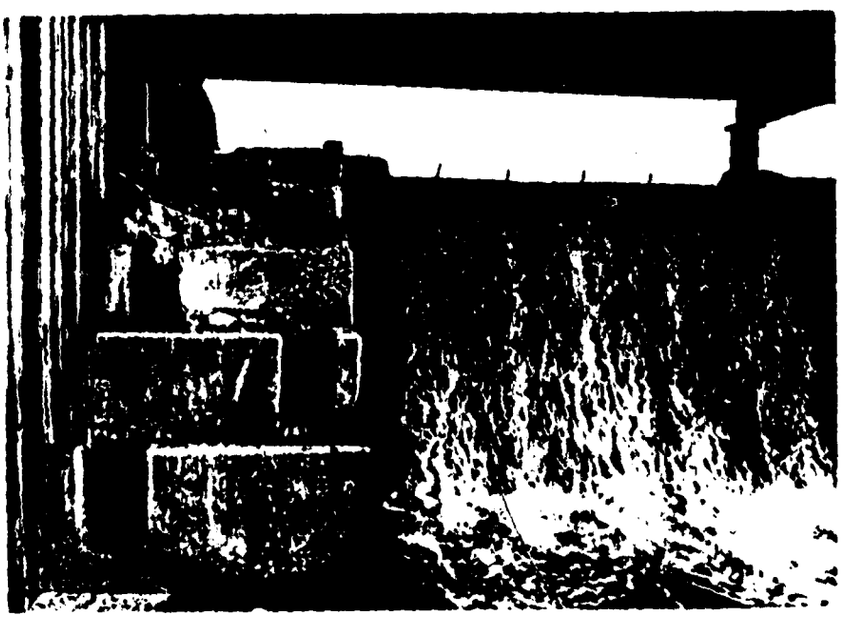
February 18, 1981

View of ogee spillway, stoplog bays, and playground on south shore of reservoir.



April 22, 1981

View of spalled concrete on crest of spillway 30 feet from left (south) end. Note brush in d/s channel at toe of spillway.



February 18, 1981

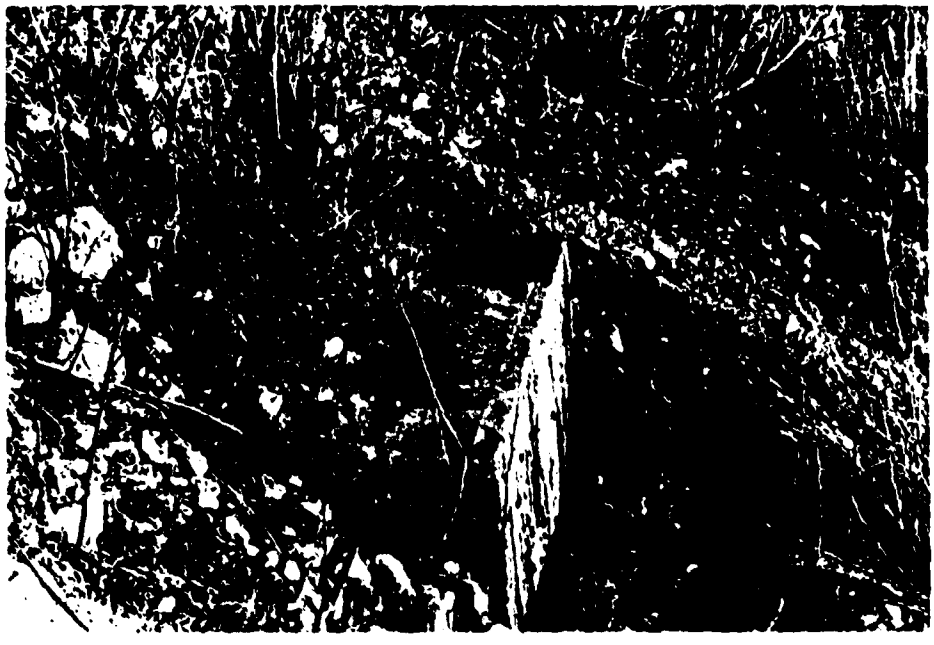
View of badly eroded and deteriorated fish ladder at right end of dam adjacent to the most northern stoplog bay.

April 22, 1981

View of asbestos cement pipe siphon at u/s end.

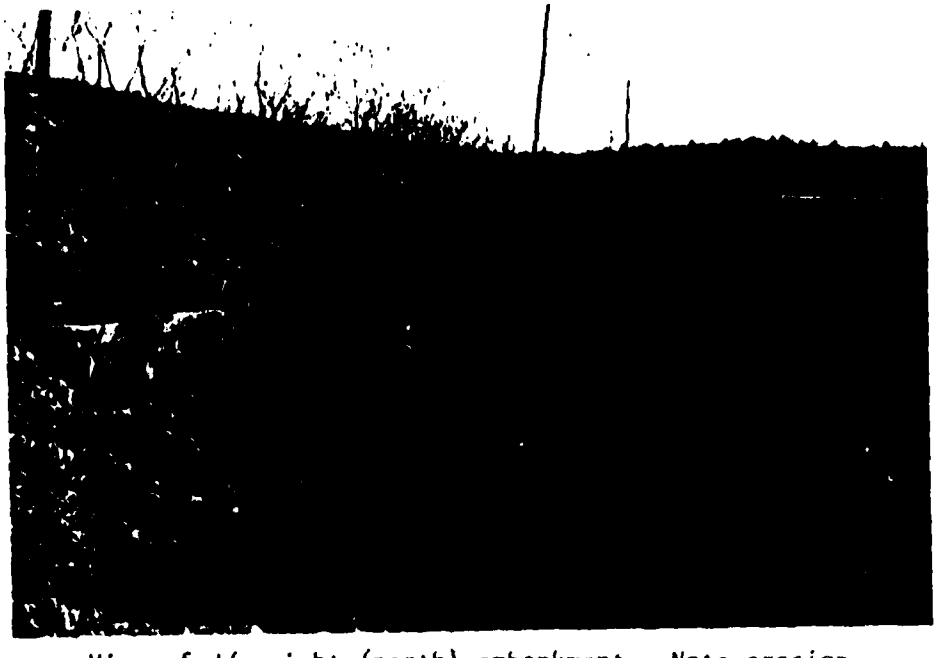
April 22, 1981

View of d/s end of 8-inch asbestos cement pipe siphon. Note erosion of d/s embankment.



April 22, 1981

View of valve box on d/s embankment - houses 2 valves.



February 18, 1981

View of d/s right (north) embankment. Note erosion, sloughing and brush on embankment.

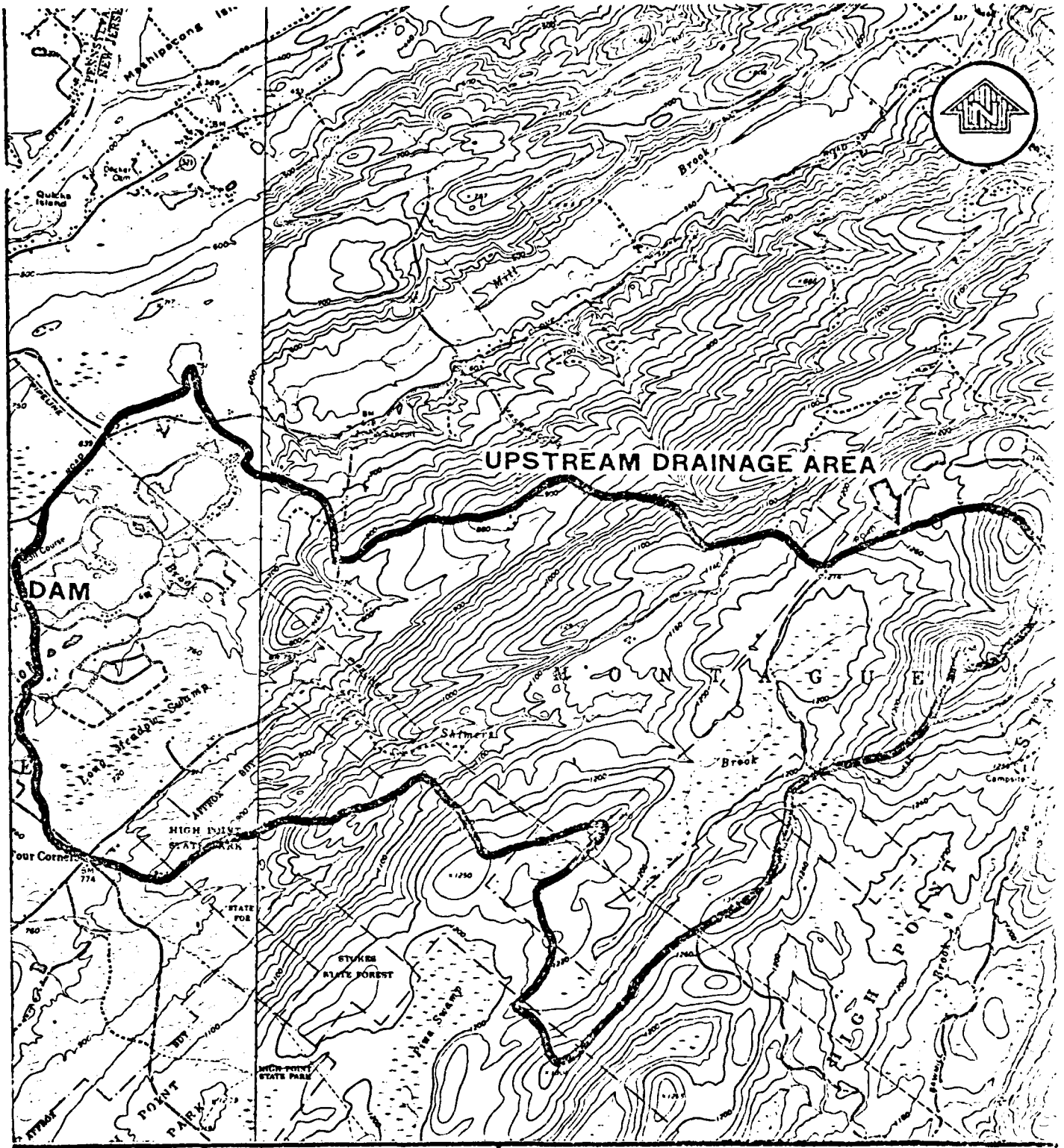
February 1[illegible], 1[illegible]

View of d/s channel and pond.

APPENDIX 4

HYDROLOGIC COMPUTATIONS

CLOVE LAKE DAM



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

CLOVE LAKE DAM
MONTAGUE TOWNSHIP, NEW JERSEY

REGIONAL VICINITY MAP

JUNE 1981

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

Anderson-Nichols & Company, Inc. BOSTON, MA.

SCALE IN MILES

0 1/2 1

MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE SHEETS. MILFORD, PA., N.J. 1958, REVISED 1969, AND PORT JARVIS, N.J., PA., N.Y. 1969.

Anderson-Nichols & Company, Inc.

Subject CLOVE LAKE DAM

Sheet No. 1 of 8

Date

Computed MBS

Checked TCG

JOB NO. 3670-02

STANKOWSKI EQUATION

$$Q_{100} = 136 A^{0.84} S^{0.26} S_c^{-.51} I^{.14}$$

$A = 5.6 mi^2$

$$S = \frac{1210 - 720}{3.13} = 156.5 ft/mi$$

$S_c = 0.67 mi^2$ WETLANDS $/ 5.6 mi^2 = 0.12 = 12\% + 1\% = 13\%$

$I = 1\%$

$$Q_{100} = 136(5.6)^{0.84}(156.5)^{0.26}(13)^{-.51}(1)^{.14} = 581 CFS$$

$Q_{100} = 581$

SPILLWAY CAPACITY from RATING CURVE = 5586 CFS

SPILLWAY IS CONSIDERED ADEQUATE

Anderson-Nichols & Company, Inc.

Subject: Clove Lake Dam

Sheet No. 2 of 8
Date [illegible]
Computed [illegible] / TCG
Checked TCG

JOB NO. 3670-02

DEVELOPMENT OF RATING CURVE

$Q = CLH^{3/2}$

1. SPILLWAY CURVE Ogee Spillway

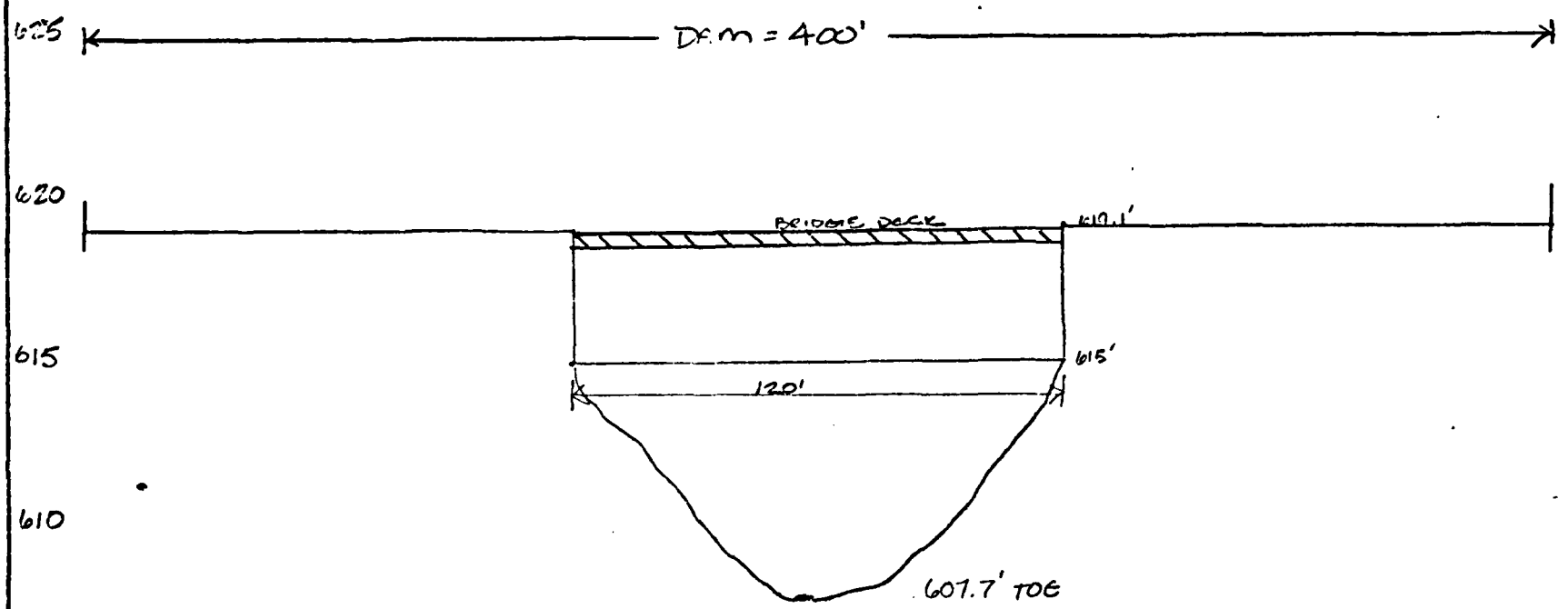
C = 3.6 L = 120 WIDTH =

2. TOP OF DAM CURVE

C = 2.7 L = 400 - 120 = 280' WIDTH = 30'

	ELEVATION (FEET)	SPILLWAY HEAD	SPILLWAY Q (CFS)	TOP OF DAM HEAD	TOP OF DAM Q (CFS)	CFS	COMBINED Q (CFS)
Spill	615	0	0	0	0		0
Top of dam	619.1	4.1	3586	0	0	0	3586
	620	5.0	4830	0.9	645		5475
	622	7.0	8001	2.9	3,734		11,735
	624	9.0	11664	4.9	8,200		19,864

BRIDGE DECK higher than 100-YR TEST FLOOD and pier widths are negligible ∴ they were not included in calculations.



Spillway Top = 3586.4

ANDERSON-NICHOLS

VERNON BOSTON CONCORD

Clove Lake Dam
Cross-Section

DATE	SCALE:	JOB NO.	SHEET NO.
6-25-81		3670-02	3 OF 6

Anderson-Nichols & Company, Inc.

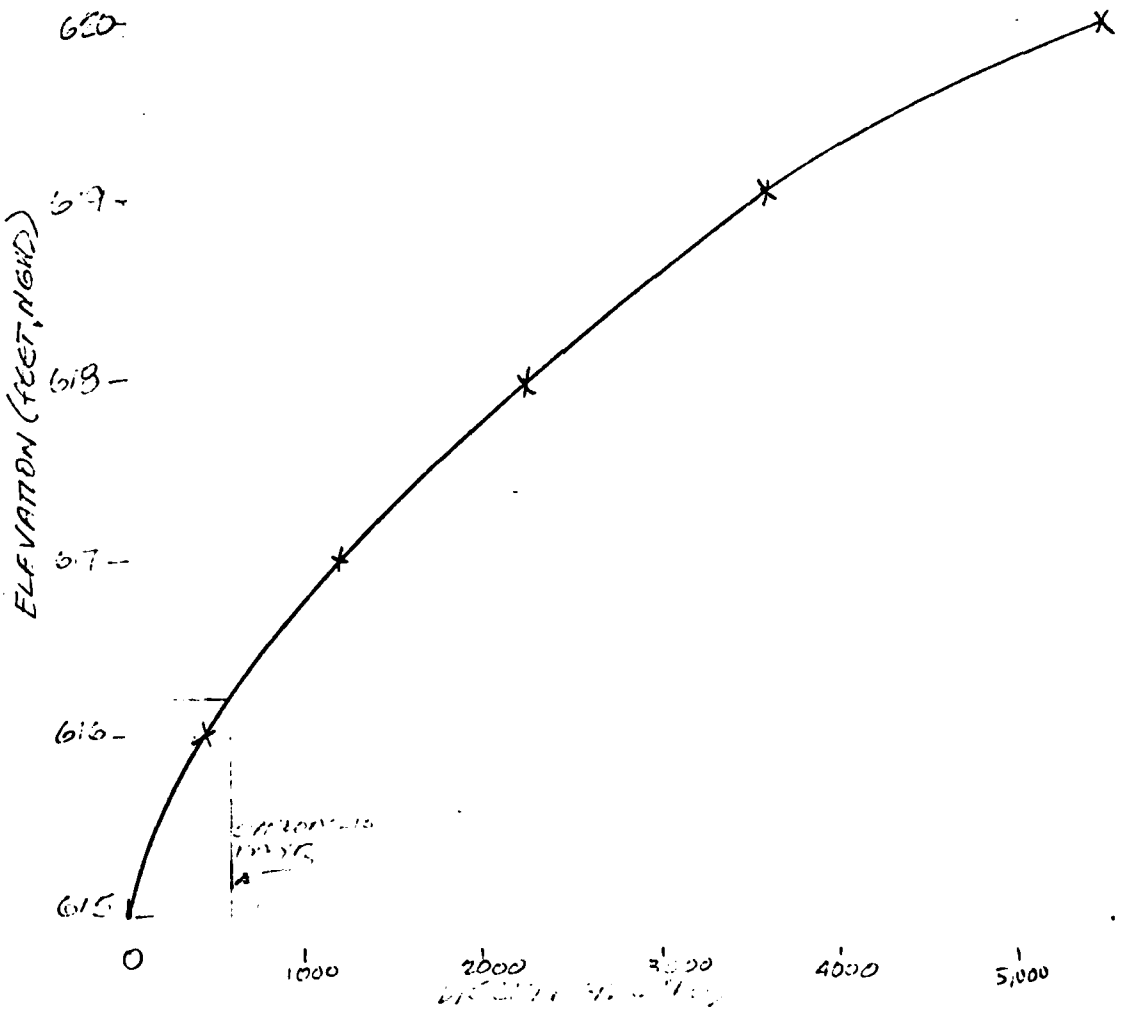
Subject Clove Lake

Sheet No. 4 of 8
Date 7/27/81
Computed JCG
Checked JCG

JOB NO. 3670-02

SQUARES 1/4 IN. SCALE

RATING CURVE



Anderson-Nichols & Company, Inc.

Subject CLOVERDALE DAM 1

Sheet No. 5 of 8
Date 6/[illegible]/81
Computed [illegible]
Checked TCG

JOB NO. 3670-02

SQUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
/4 IN. SCALE

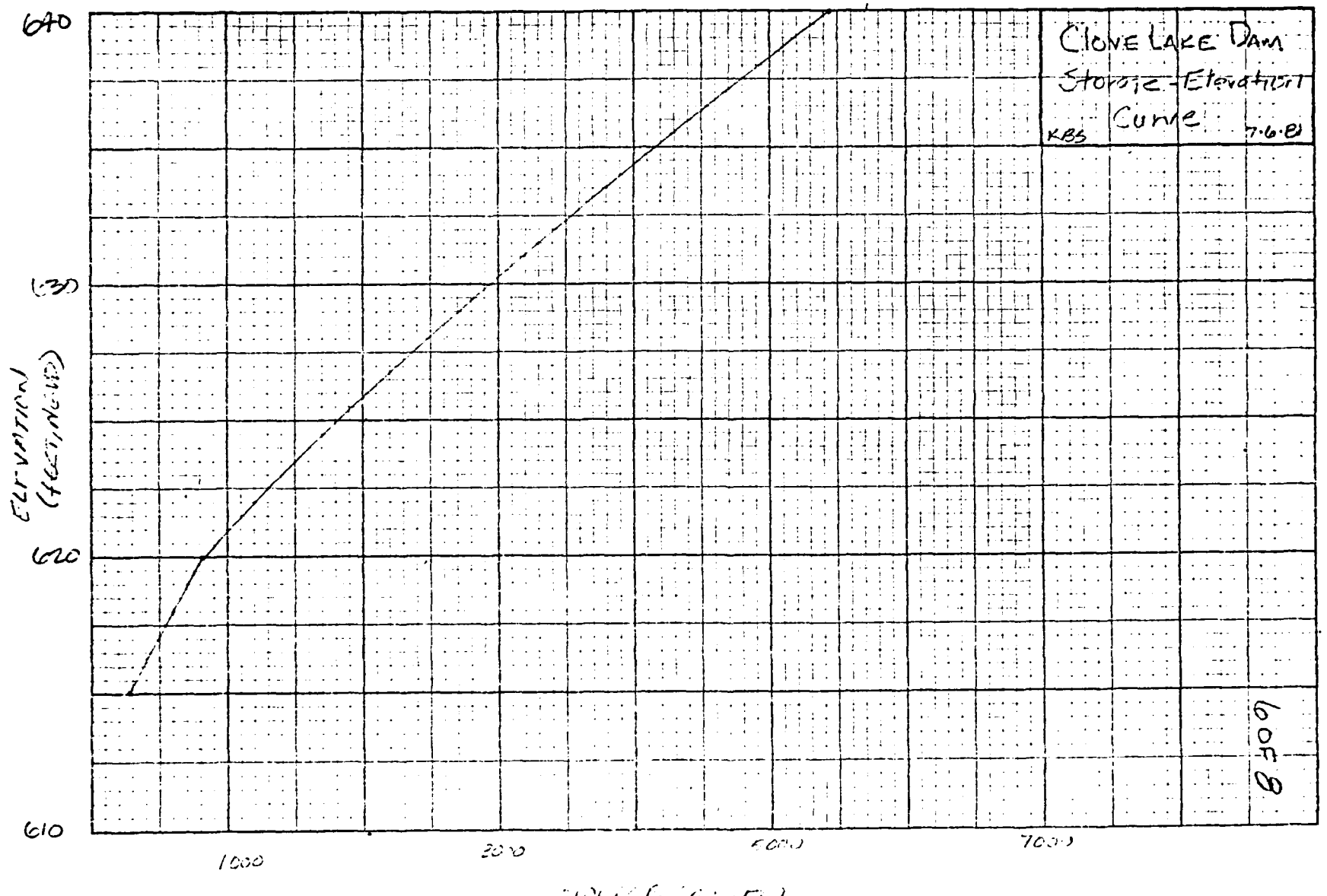
STAGE-STORAGE DETERMINATION

AVE. DEPTH OF LAKE = 4'

ELEVATION (FT)	SURFACE AREA (AC)	AVE. A (AC)	INCREMENTAL STORAGE	CUMUL. STORAGE
615	72.3	72.3	289.2	289.2
620	135.5	103.9	519.5	808.7
640	326.7	231.1	4622	5430.7

INPUT FOR HEC1 (FROM CIVIL C)

	STAGE (FT)	STORAGE (AC-FT)
IOC	607.7	0
SPILLWAY	615.	289
	619.1	710
	620	809
	622	1200
	624	1600



Drawdown Time

Determination of "C" for low level outlet - 2 18-inch pipes

D = diameter = 1.5' (2 pipes) = 18" (2 pipes)
n = 0.013 for concrete pipes
A_p = area of pipe opening = 2 pipes at $\pi(0.75)^2$ = 2 pipes at 1.77 = 3.54 sq ft
L_p = 85'
K_f = friction loss through pipe

$$K_f = \frac{5097 n^2}{D_{inches}^{4/3}} = \frac{5087 (0.013)^2}{(18)^{4/3}} = 0.0182$$

K_L = entrance loss to pipe = 0.8

C_p = Coefficient of discharge

$$C_p = A_p \sqrt{\frac{2g}{1 + K_L + K_f L_p}} = 2(1.77)\sqrt{\frac{64.4}{1 + 0.8 + 0.0182(85)}} = 15.53$$

$$C = C_p / A_p / \sqrt{2g}$$

$$= \frac{15.53}{[2(1.77)]\sqrt{64.4}} = 0.547$$

Assume:
1. no inflow
2. 2-18" pipes, $Q = 15.53 H^{\frac{1}{2}} = 15.53 (E - 608.25)^{\frac{1}{2}}$
3. Invert at 607.5 → H = E - (607.5 + 0.75) = E - 608.25
4. Ac-Ft/day = $Q_{Avg} \times 1.9835$
5. Days = $\frac{\Delta \text{ Storage}}{\text{Ac-ft/day}}$
6. Straight-line variation in storage from 0 at 607.7 to 289 ac-ft at 615 (see page 6)

Anderson-Nichols & Company, Inc.

Subject Clove Lake Dam

Sheet No. 1 of 8
Date 3-5-81
Computed IEH
Checked SM

JOB NO.

Elevation (Ft. above NGVD)	Storage (Ac-Ft)	Δs (Ac-Ft)	Q (CFS)	Q_{AVG} (CFS)	Ac-Ft/Day	Days
615	289		40.3			
		39.6		38.75	76.9	0.51
614	249.4		37.2			
		39.6		35.5	70.4	0.56
613	209.8		33.8			
		39.6		31.95	63.4	0.62
612	170.2		30.1			
		39.6		27.95	55.4	0.71
611	130.6		25.8			
		39.5		23.15	45.9	0.86
610	91.1		20.5			
		39.6		16.95	33.6	1.18
609	51.5		13.4			
		51.5		6.7	13.3	3.87
607.5	0		0			

Σ = 8.31 days

APPENDIX 5

REFERENCES

CLOVE LAKE DAM

APPENDIX 5
REFERENCES

CLOVE LAKE DAM

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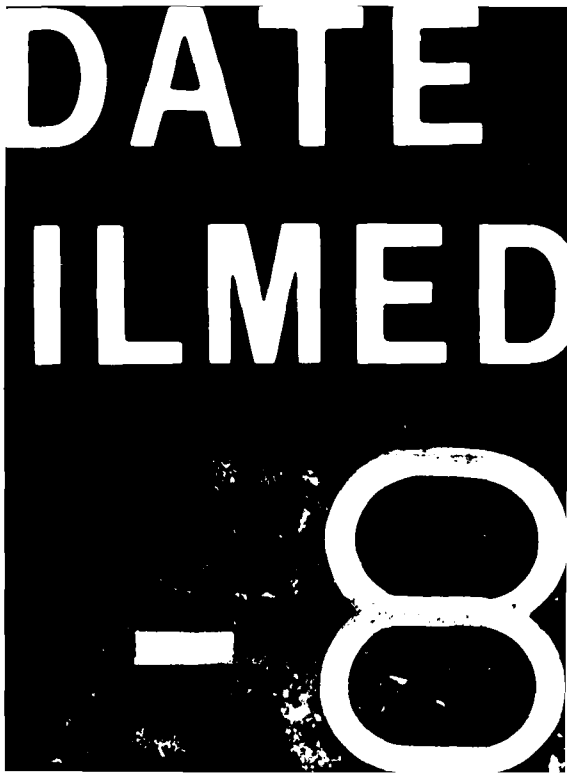
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